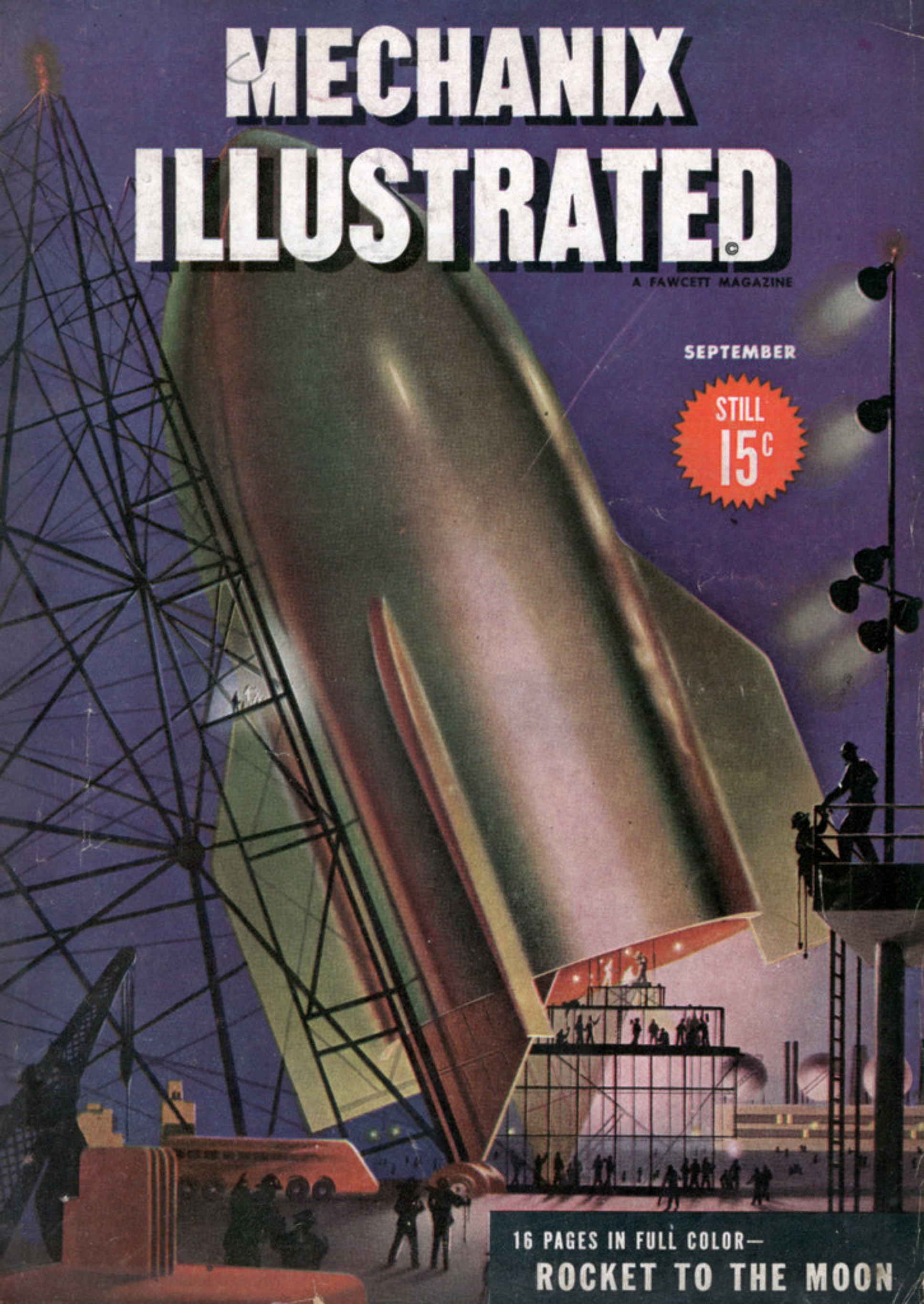


MECHANIX ILLUSTRATED



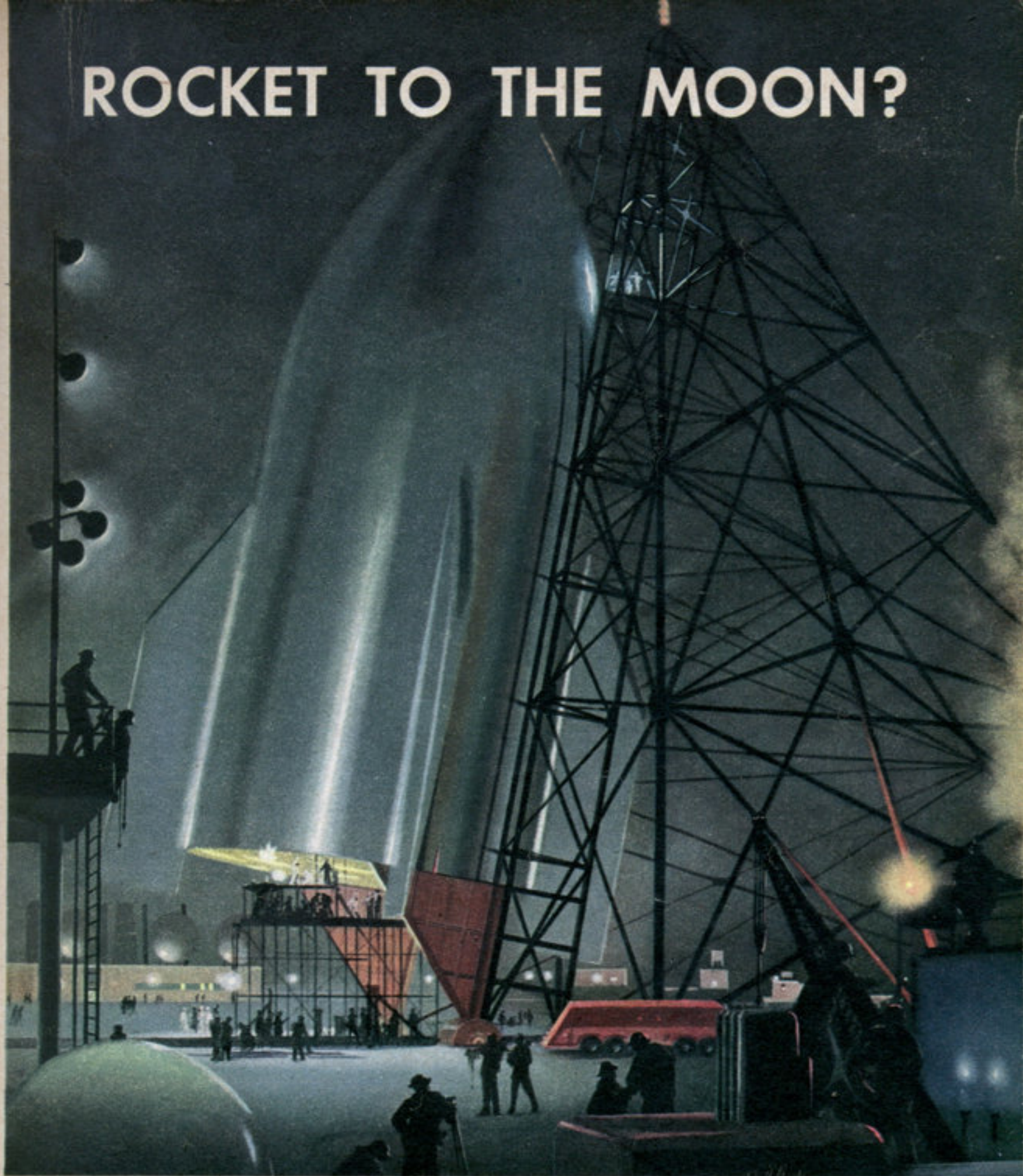
A FAWCETT MAGAZINE

SEPTEMBER

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16 PAGES IN FULL COLOR—
ROCKET TO THE MOON

ROCKET TO THE MOON?



The rocket ship stands on its launching rack ready for its journey through space.

The favorite theme of science fiction is no longer a fantasy—latest advances in rocket research make it a distinct possibility.

BY WILLY LEY

Charter Member of British Interplanetary Society and Author of Rockets—Future of Travel Beyond the Stratosphere

THE STORY OF THE MOON-GUN

WITH the exception of an occasional comet, our moon is the nearest of all celestial bodies. Its average distance, in

round figures, is 240,000 miles. Sometimes it is distant by 13,000 miles more, sometimes, when the moon is closer in its orbital gyrations, it is almost 20,000 miles less. The

average, or mean, of all the possible distances is 240,000 miles; or, if you want to be more precise, 238,900 miles.

As astronomical distances go, this is very close indeed; it is not even very far when a purely terrestrial yardstick is applied. I know a Hollywood producer who, for business reasons, has to come to New York five times every year. After eight years of flying to New York five times a year and back, he will have travelled the whole distance to the moon. Taken as one trip, it would be 900 hours on a fast transport, 600 hours on a modern fighter plane.

Of course, one cannot fly to the moon. The earth's atmosphere extends to about 250 miles from the ground, which is roughly one per cent of the distance to the moon. And only three per cent of the height of the atmosphere is suitable for flying.

This fact was realized fairly early, roughly ten or fifteen years after the invention of the balloon in 1783. It is amusing to see that before the invention of the balloon there were many crackpot inventors of flying machines of various kinds, each one of them promising flight at high altitude and great speed, and each one winding up by saying that one might eventually reach even the moon with that machine "to bring plants

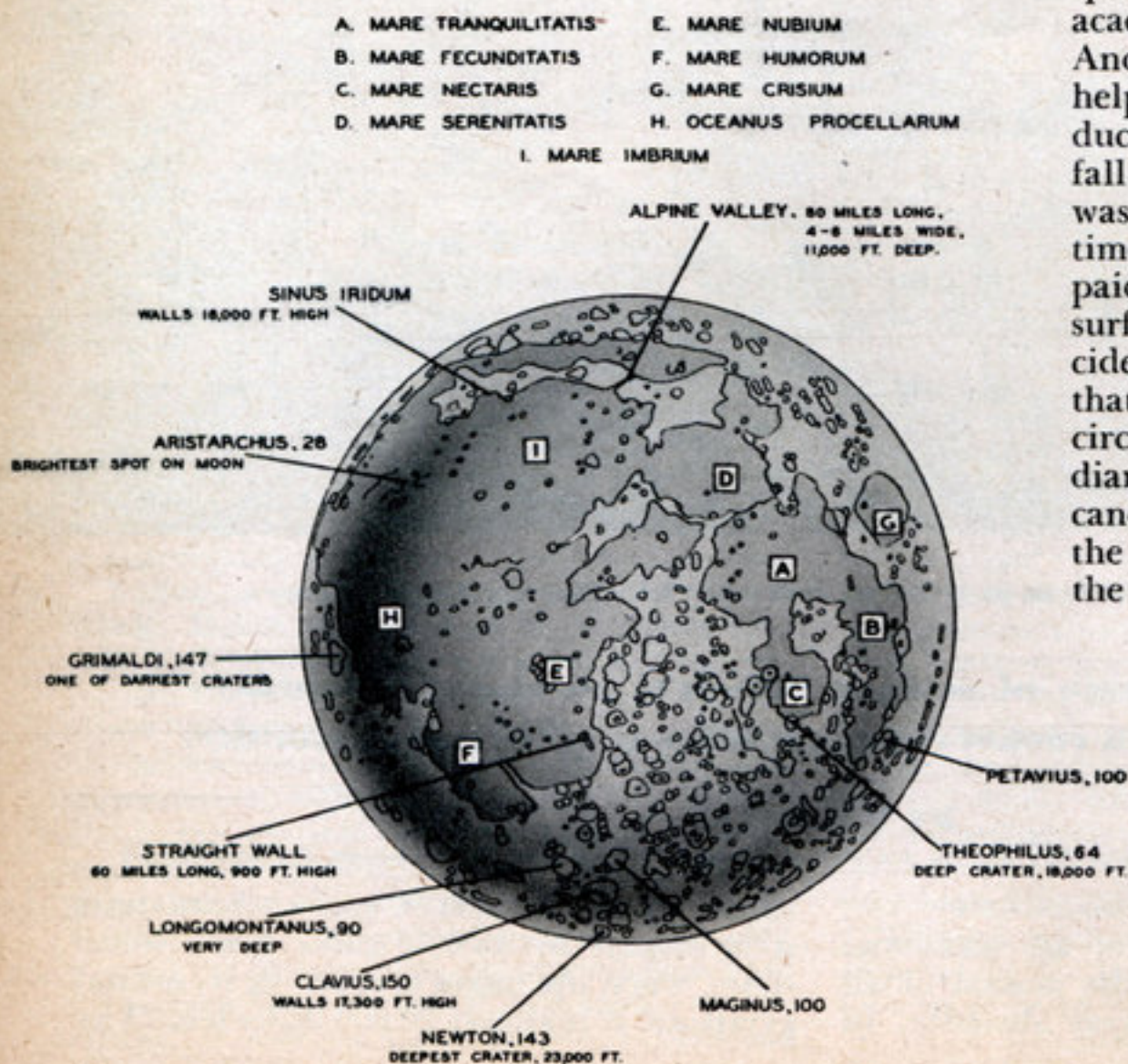
and animals from there as one now brings monkeys and peacocks from Asia." After the balloon was invented there were still many crackpot schemes for flying (and a few serious ideas), but nobody promised any more that the moon would be reached. All that was promised then was that "the machine" would be able to fly in the direction desired by its pilot, something that a balloon could not do.

Around the middle of the last century the idea began to crop up that one might be able to shoot to the moon. To most people this idea is connected with one name, that of the great French novelist, Jules Verne, who wrote two novels about it, the first of which, *From the Earth to the Moon*, was printed for the first time in 1865. But Jules Verne did not get his idea out of thin air; there was a little history to it even then.

Strangely enough, the shaping of the idea of a moon gun was based on a mistake. Just a few decades before Jules Verne, a German scientist by the name of Chladni had proved that there were actually such things as meteorites. Up to Chladni's time, learned societies had steadfastly refused to believe that stones could fall from the sky. Chladni collected all the evidence which he could gather, which was a lot, and showed that, in

spite of the attitude of official academies, meteorites did fall. And Mother Nature herself helped the case along by producing a rather spectacular fall a few years after the book was published. At the same time several astronomers had paid special attention to the surface of the moon and decided that all the little circles that can be seen there—"little circles" up to eighty miles in diameter—were extinct volcanoes. It was easy to combine the two ideas and suggest that the meteorites that fall onto the earth may originally have been material ejected from the volcanoes on the moon.

We now know that at least the vast majority of



Here is your tourist's map of the moon, showing the leading ranges, craters and seas. Numbers are diameters in miles.

Mechanix Illustrated

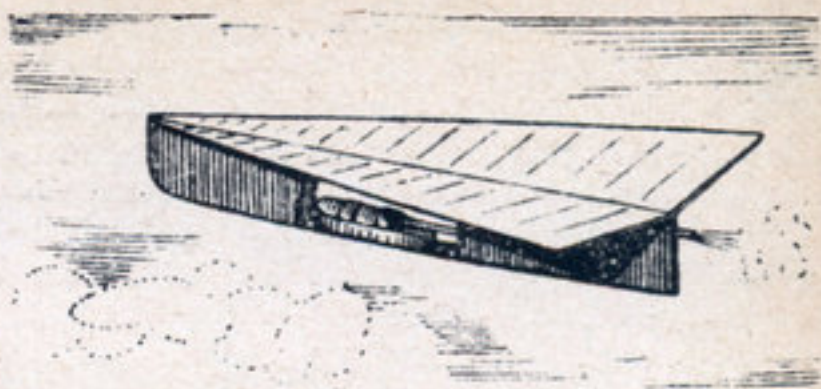
the lunar "craters," instead of having once ejected meteorites, are, on the contrary, the results of a bombardment with meteorites, of the type of famous Meteor Crater in Arizona. But around 1850 things were believed to have worked the other way round (Meteor Crater was undiscovered then), and mathematicians set out to investigate the case with the means of their own science.

The mathematics of the problem worked as follows: If a lunar volcano ejected a stone with an initial velocity of, say, half a mile per second, that stone would climb against the moon's gravity to a certain height. Then it would fall back, striking the moon's surface with a velocity of half a mile per second; natural law states that the velocity of impact for a fall from a certain altitude is the same as the velocity of departure required to reach that same altitude. If the stone were ejected with a velocity of a mile per second precisely the same thing would happen, but in the process the stone would reach a much higher altitude than the first, many times as high, in fact, although the velocity were only double.

The point is that there is a limit to the velocity required, even though the distance may be unlimited. If a stone fell to the moon from a literally limitless distance, "from infinity" as mathematicians say, it would not strike with an infinite velocity but with a definite velocity that can be calculated. Since the same velocity would enable the stone to leave the moon "for infinity," it is called "velocity of escape," or "velocity of liberation."

In the case of the moon, that escape velocity amounts to 2,370 meters per second, or 1.47 miles per second; in the case of the earth it amounts to 11,180 meters per second, or almost precisely 7 miles per second. Thus the moon volcanoes (if they were volcanoes) would have to impart a velocity of one and a half miles per second to their stones if they were to fall to the earth. A terrestrial volcano, to bombard the moon, would have to impart a velocity of 7 miles per second to its "bombs," plus whatever were needed to overcome air resistance.

It was here that Jules Verne took up the threads of scientific reasoning to spin his yarn. In brief, he said that a fictitious "Gun Club" in Baltimore proposed to build a gigantic cannon in Florida, capable of send-



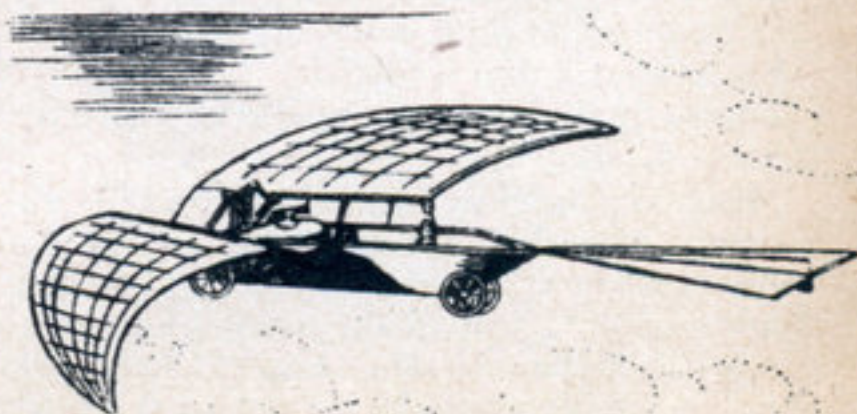
This 1867 design for a steam-reaction space vehicle resembles the toy paper gliders of modern times.

ing a 9-foot ball to the moon, while simultaneously a new gigantic telescope was to be built which would enable astronomers to see the ball when it got there. The story then gets complicated by the substitution of a hollow shell for the ball and three men volunteering to travel in it. These complications do not interest us here; the question is whether such a gun could be built and whether it would work.

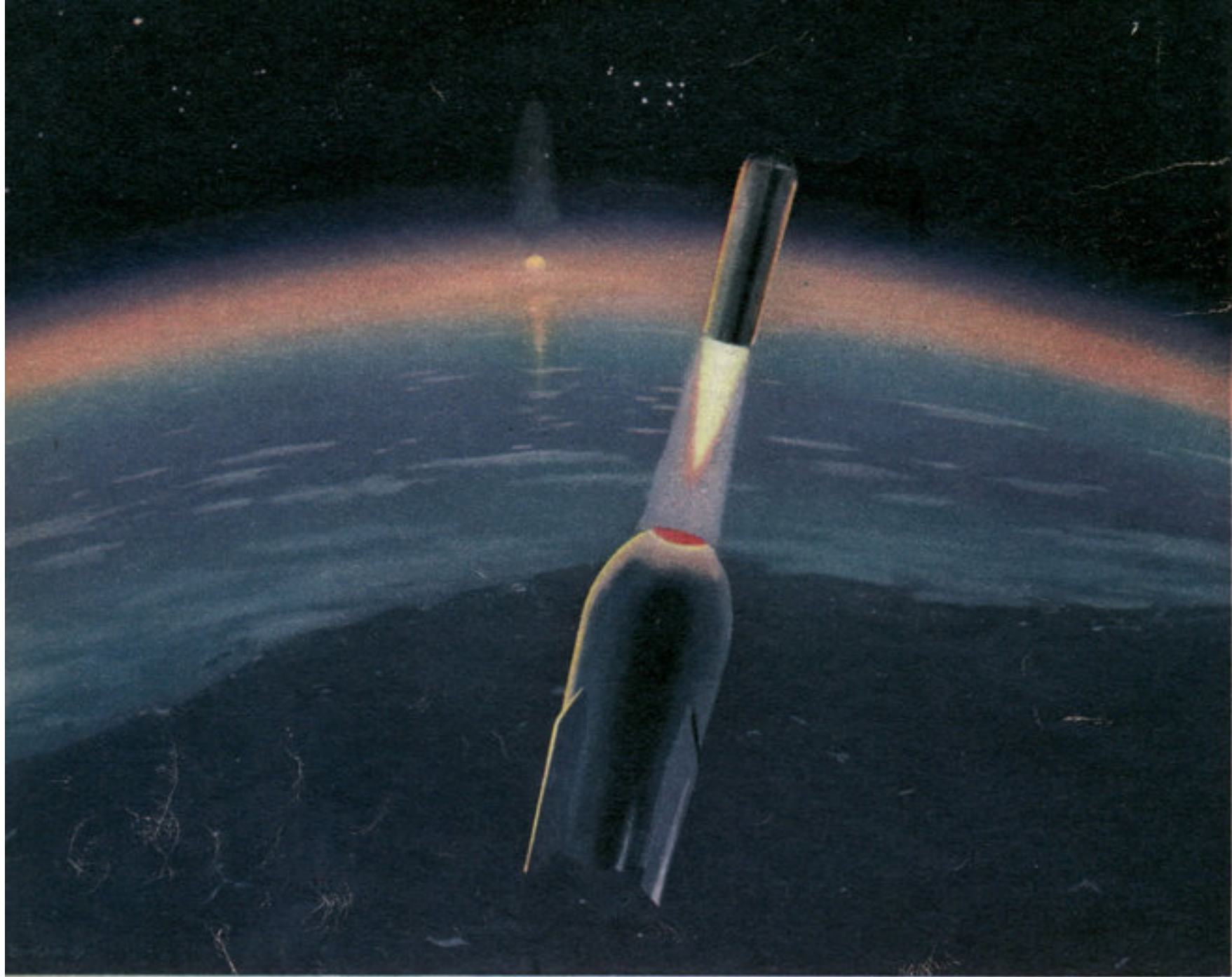
The main figures, as given by Jules Verne, are correct. If the projectile left the atmosphere with a velocity of 7 miles per second, it would need 83 hours and 20 minutes to reach the (imaginary) point where the attractions of earth and moon were equally powerful.

Just "crawling" across that point (in which, contrary to the assertions of Jules Verne, one could never "get stuck"), the projectile would come into the grip of the moon's gravitational attraction and fall toward the moon. This would take another 13 hours and 53 minutes, making a total of 97 hours and 13 minutes.

It was proposed that the moon gun be 900 feet long, poured into a 900-foot well, so that the metal of the cannon be only the lining of a barrel with walls of indeterminate thickness, the soil of Florida. 400,000 pounds of guncotton (an arbitrary amount) were to be put into the gun, filling the bot-



A German, Werner von Siemens, planned this rocket airplane in 1845. Fuel was to have been guncotton.



Ship No. 1, containing the passengers, leaves Ship No. 2 at altitude of 1,200 miles above Kansas. Pacific Coast is visible from San Diego to Puget Sound.

tom part up to a height of 200 feet so that the useful length left be only 700 feet. This was supposed to produce a muzzle velocity of 54,000 feet per second, of which Jules Verne expected to lose $\frac{1}{3}$ to air resistance, so that the projectile would emerge from the atmosphere at 36,000 feet, or about 7 miles, per second.

Jules Verne was perfectly well aware that nobody could travel in such a projectile and survive; but if he had been asked whether the gun itself would work, he would probably have said that it might.

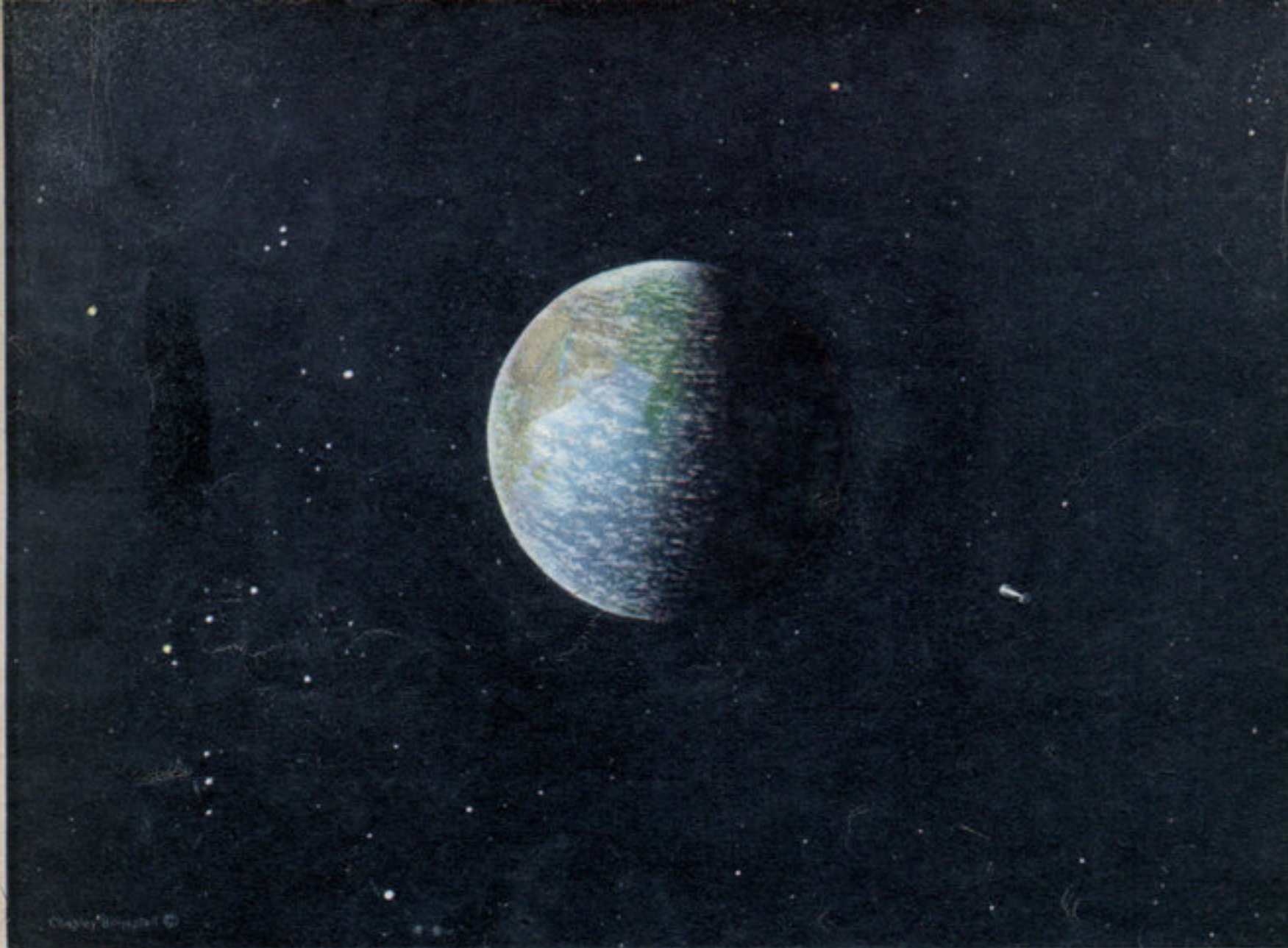
Actually the projectile would hardly have left the barrel!

Verne completely forgot that there is air resistance inside the barrel, too. Above the projectile there is a cylinder of air, 700 feet high and nine feet in diameter. Since the projectile is to move much faster than sound, that air cannot possibly get out of the way; the projectile could not push it out of the barrel; all it could do is to compress it. Since

air grows hot when compressed, the projectile would be pushed from below by hot explosion gases and would experience a counter-push from above by highly compressed and very sluggish and at the same time very hot air. The projectile would be between two very hot and very powerful pistons and would most probably be crushed between them and volatilized by the heat.

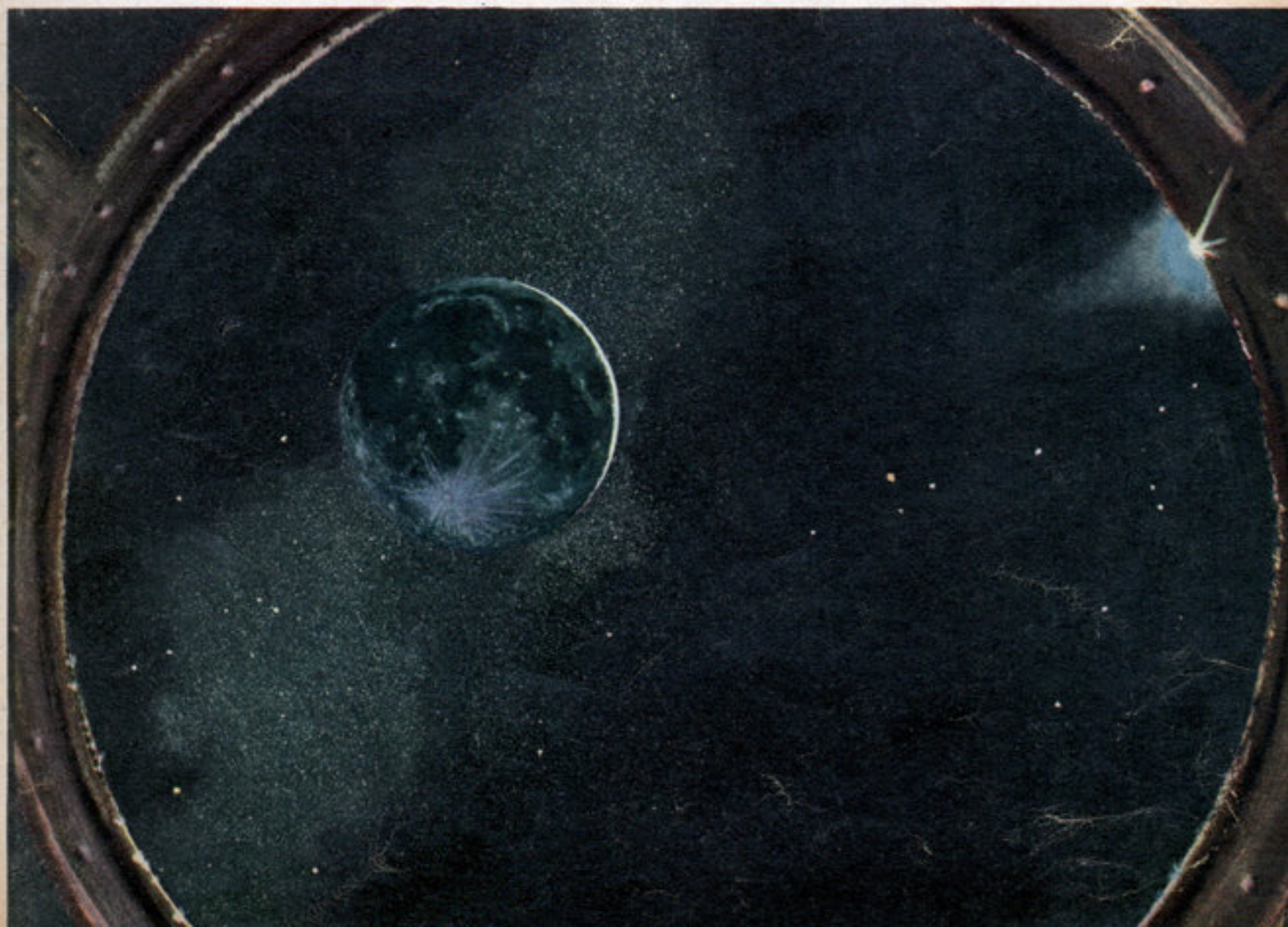
The science of ballistics has progressed considerably since Verne wrote this story, and the question is justified whether we could do better now. Could modern experts design a better moon gun? One that would work, if built?

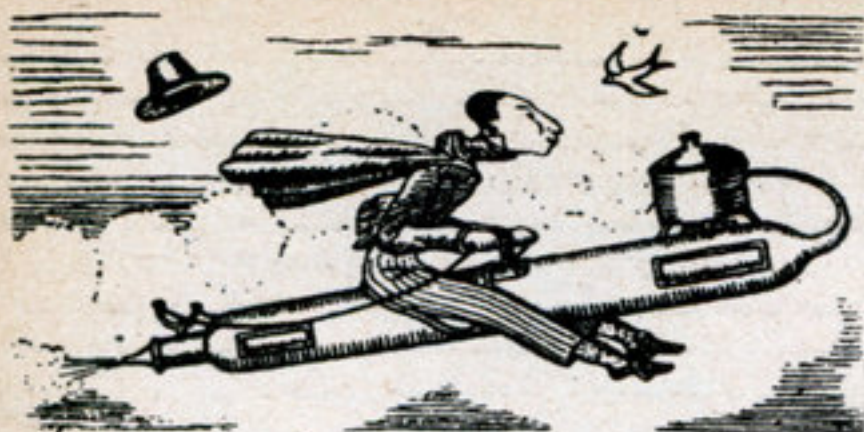
It has been tried, not because anybody seriously wanted to do it, but only to see whether it could be done at all. The main difficulty, of course, is air resistance, both inside the barrel and outside. The first can be remedied by pumping the air from the barrel and closing the muzzle with a lid. Since it would be impossible to pump all air



We are 35,000 miles from the earth (above). Constellation of Orion is at left, Pleiades at upper right. Space ship at lower right is $\frac{1}{2}$ mile away.

The moon, "new" phase, is 15,000 miles away (below); beyond is Scorpio and a part of Milky Way. Earth-light is illuminating the dark surface of moon.





Golightly's projected "Steam-Horse" of 1841 bore the title, "From Paris to St. Petersburg in one hour."

from the barrel the slight remainder would be compressed by the moving projectile and that "cap" of compressed air would push off the lid before the projectile actually reached it. So far everything is fine. Now for the air resistance outside the barrel.

The easiest way to avoid a great deal of it would be to pour the cannon into a well dug into the top of a high mountain; then the densest layers of the atmosphere would be below the muzzle. It would help to make the shell very heavy per square inch of cross section, because such shells penetrate air resistance better than others. It should be made of a high-grade steel alloy and be practically solid, if not wholly so. The tentative solutions reads: the shell should have a caliber of 48 inches and a length of 300 inches; the barrel of the cannon must be 3,000 feet long, instead of 900; and must be sunk into a mountain near the equator with the muzzle at least 16,000 feet above sea level.

Such a gun might be expected to do what Jules Verne's fictitious piece was supposed to do: get a projectile safely through the atmosphere with a muzzle velocity great enough to prevent its return.



Hardly had these calculations been published when another mathematician, who had actually worked with heavy artillery, stated that he had also toyed with the idea of Jules Verne's moon gun. He had come to the same general conclusions as the other investigators, except that he had put his muzzle 20,000 feet above sea level. And he had had to do something else: according to his experience, the powder gases generated at the bottom of the deep barrel well would simply not be able to follow the shell fast enough. It would be necessary, therefore, to attach at least one-third of the propelling charge to the shell itself, and to have a number of extra firing chambers along the length of the barrel, leading into it from the sides.

Built that way the moon gun *might* work. But, it cannot be predicted whether it could be built. Nor could the cost be predicted, although there is no doubt that it would be enormous. And, finally, nobody could supply any valid reason for the expenditure of so much money for an experiment without any practical advantages.

But the theoretical investigation of Jules Verne's moon gun did have a useful result: it pointed to the possibility of using rockets.

THE MOON ROCKET

There are many reasons in favor of such a change to another method of propulsion. Theoretically, any rocket which has grown beyond a certain minimum size and which has a burning time of more than, say, half a minute, is capable of outracing any artillery projectile past, present, or future. V-2 has shown that that theory is correct. Consequently, promises of rocket theory for still higher speeds can be accepted without reservation, even though there are some difficulties. For the present we'll just keep in mind that the theory promises such higher velocities.

At least as important as that promise is the fact that a rocket which goes up vertically for an indefinite distance will find much less air resistance than a shell. A shell has its highest velocity at the muzzle of the gun; a rocket takes off very slowly and increases its velocity steadily while climbing. Since the air is densest at sea level the shell is at an enormous disadvantage for vertical fire: the air is densest, and air resistance highest,

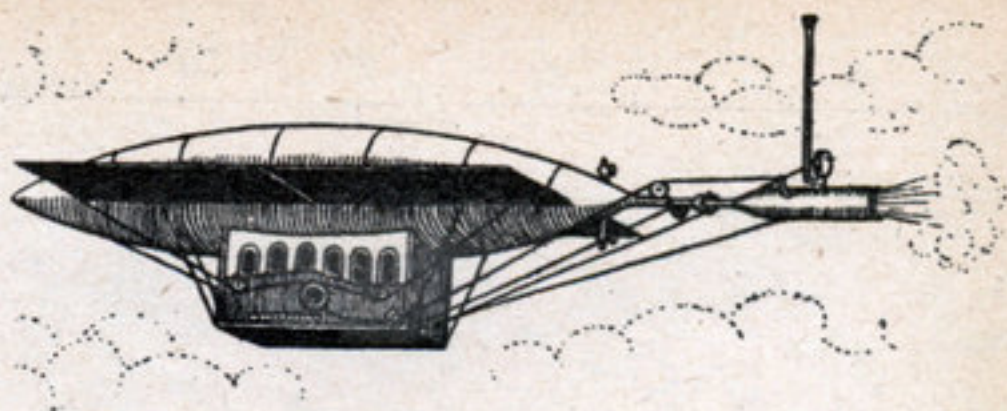
Phillips, 1850, built a working model of a reaction helicopter, running on steam; exhaust drove rotors.

just where the shell is fastest!

The rocket, on the other hand, takes off about as fast as an express elevator. At a height of two or three miles it is as fast as a modern pursuit plane. At six or seven miles it has reached the velocity of a rifle bullet, but up there the air is already so thin that the air resistance becomes bearable. When the velocity of the rocket reaches several miles a second, the surrounding air is attenuated to what we would call a vacuum if we had it on the ground and inside a vacuum tube. Even that "vacuum" still offers considerable resistance when you go at the rate of several miles per second, but that resistance is nothing compared to what would be encountered closer to sea level. Besides, you can stretch the whole air resistance question a little more in favor of the rocket if it does not take off from "a lonely island in the Pacific," meaning sea level, but from a high mountain, so that the densest layers of the atmosphere are beneath it even before the rocket begins to work.

This, I think, will explain the statement that a rocket will find much less air resistance than a shell; it just happens that it is much better suited by its natural performance to overcome air resistance during a vertical ascent. Now we come to the other statement: that rockets are better suited to attain high velocities even aside from the air resistance problem. The reason, condensed into one sentence, is that the ultimate velocity of a rocket depends not only on the nature of its fuel but also on the amount of fuel. At first glance this does not seem to make any sense, a point which was brought home to me one day during a lecture when a young man in the audience jumped up and declared that he had not paid his admission in order to listen to nonsense. With his motorcycle, he stated, he could make up to 55 m.p.h. He would be willing to concede that he might be able to make 65 or 70 m.p.h. with a better fuel; but it certainly did not influence his speed whether he had half a gallon in his tank or three gallons.

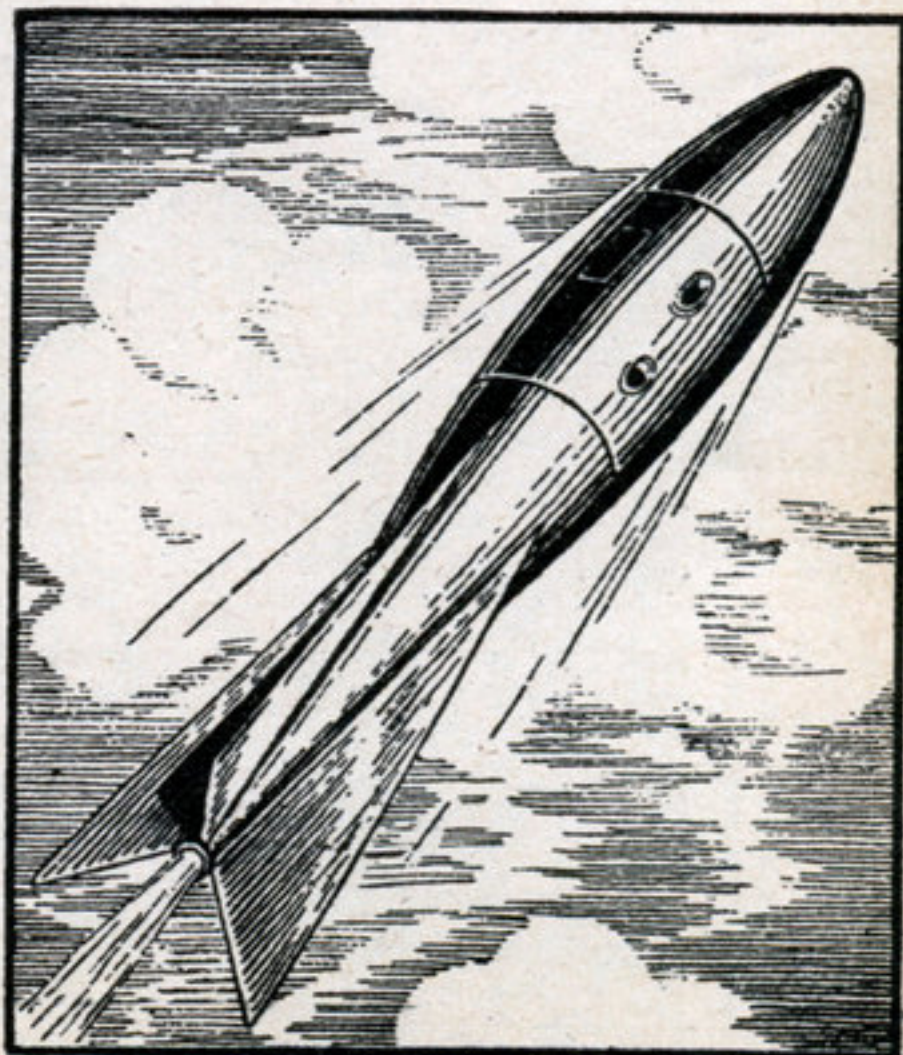
The mistake made by the excited



In 1893 Sumter Batley was granted a U. S. patent on a rocket airship, driven by machine-gun-like engine.

young man who wanted (and got) his money back is quite common. The point is that vehicles of any kind, whether floating, rolling or flying, cannot be compared with rockets. All such vehicles accelerate until they reach their top speed and then stop accelerating. A rocket, ascending vertically, accelerates until it is out of fuel. This is a very important difference which sets the rocket apart from anything else in existence.

What happens when a rocket charge is ignited is simply that the charge, via combustion, is changed into hot gas under high pressure. Escaping through a specially shaped exhaust nozzle, the gas creates a recoil of the same kind as the recoil of a gun, except that it lasts longer. If the rocket weighs, say ten pounds, and the recoil is twenty pounds, the acceleration is, at first,



Drawings from *Rockets* by the author

Oberth rocket forecast the V-2. Russians called it, "Moonship secretly built in U. S."

As the moon is approached by our rocket ship, its craters, seas and mountain ranges become visible; here, ship is 500 miles above its surface. Moon is terrestrial body with no atmosphere.



At 10 miles above the moon's pole, the gigantic craters and jagged ridges present an awesome picture. Temperature of shadows is far below Zero; in sun it is hundreds of degrees.



1 g, which means that the speed will go up at the rate of 32 feet per second for every second elapsed. You can figure out for yourself how the velocity will go up, especially if you have a higher acceleration than 1 g to begin with. And the acceleration will go up later on at any event. The thrust stays the same as long as the charge burns, but as the charge is used up the weight of the rocket decreases. The acceleration, consequently, increases.

It can easily be seen now why the amount of fuel is important. The acceleration lasts until all the fuel has been burned. The more fuel, the longer the period of acceleration, the higher the final velocity.

But what about the nature of the fuel? How does that come in?

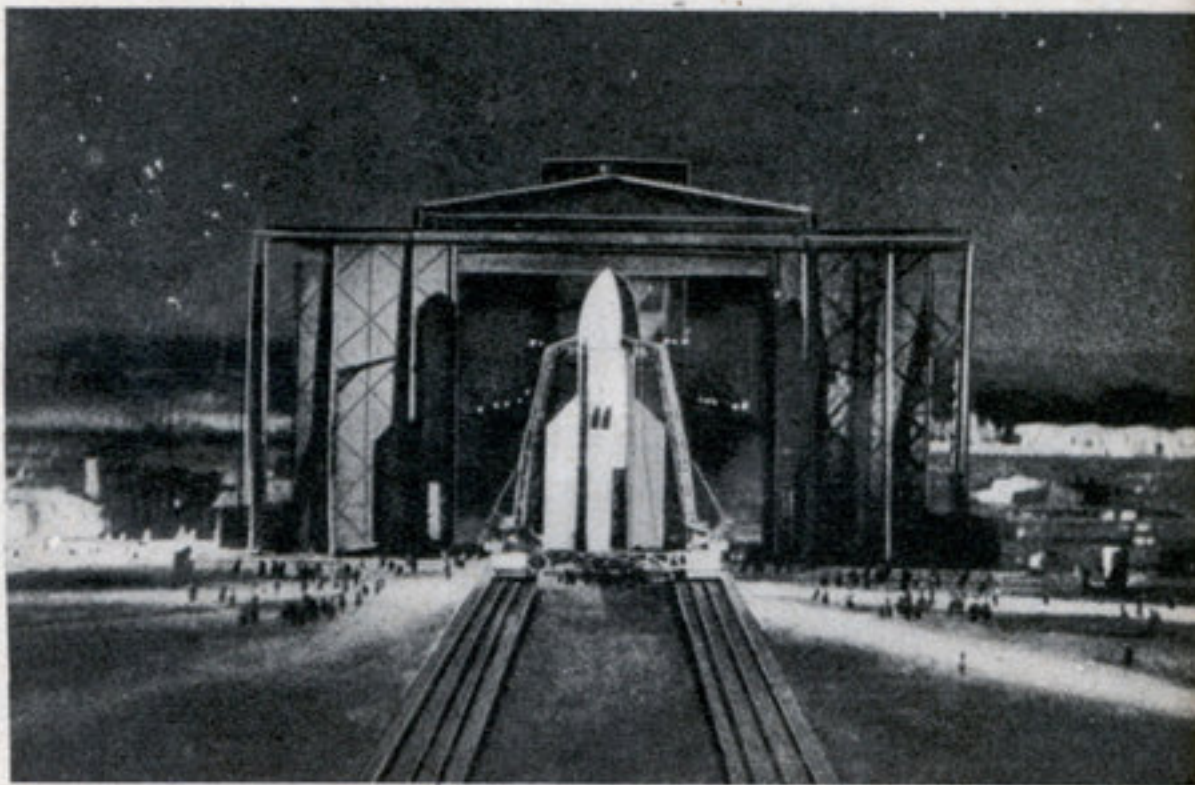
The velocity with which the combustion gases escape through the exhaust nozzle is called "exhaust velocity." In actual tests it has been found to range all the way from 2,000 feet per second to about 7,000 feet per second, *depending on the nature of the fuel*. The lower figure refers to ordinary rocket powder as it is used in skyrockets, the higher to light fuel oil burned with liquid oxygen. It is this exhaust velocity which determines the thrust and, consequently, the acceleration, while the fuel supply determines the duration of acceleration.

Now we can go back to the problem of the moon rocket. Obviously it is just a question of having a sufficiently powerful fuel (meaning the one with the highest exhaust velocity), and enough of it. The velocity to be attained is seven miles per second at the fringe of our atmosphere. What fuel should we use and how much of it would we need for that? The most powerful chemical fuel known at present is hydrogen burned with liquefied ozone, but there are important engineering difficulties to be overcome. These difficulties have been solved for the somewhat less powerful gasoline burned with liquid oxygen, delivering an exhaust velocity that might be forced up to 8,000 feet per second.

Will that do?

There exists a mathematical law that can be questioned on that score. It states that the "mass-ratio" (which is the ratio between the fully fuelled and the empty rocket) has to be 2.72 to 1 if the velocity of the rocket is to be equal to its own exhaust velocity. That, of course, holds true for any exhaust velocity. In our case, with about 8,000 ft. p. sec. at our disposal, such a mass-ratio is far too low; 8,000 ft. p. sec. is only about $1\frac{1}{2}$ miles, and we need seven. If the rocket is to attain twice the velocity of its own exhaust, the mass-ratio has to be the square of 2.72; if it is to go three times as fast, the mass-ratio is to be the cube of 2.72, which is about 20.1.

From these figures it is obvious that the mass-ratio goes up at an alarming rate, a fact which is one of the greatest stumbling blocks to rocket advance. There is the further complication of air resistance, which must be overcome. This means additional fuel, and still more fuel to carry that initial supply part of the way. The whole calculation is too complicated to be explained here, but the results are given in the table immediately below:



Scene from prewar German film by Fritz Lang on space travel, titled, "Woman in the Moon," shows the space ship about to leave its hangar.

If the exhaust velocity is:	the mass-ratio required for a moon rocket is:
3,270 yards p. sec.	237
4,365 yards p. sec.	60
5,460 yards p. sec.	26
10,936 yards p. sec.	5.5

(The mass-ratio of V-2 is slightly above 6:1, but its exhaust velocity is only about 2,000 yards per second.)

So far not even 3,000 yards per second have been attained. That figure will have to be doubled before one could even seriously think about making the experiment. Then it might be tried; by having a larger rocket carrying a smaller one part of the

have to progress to make it possible later. The requirements are high, but not impossible, and they are likely to be met before most of us who read this now have time to die of old age.

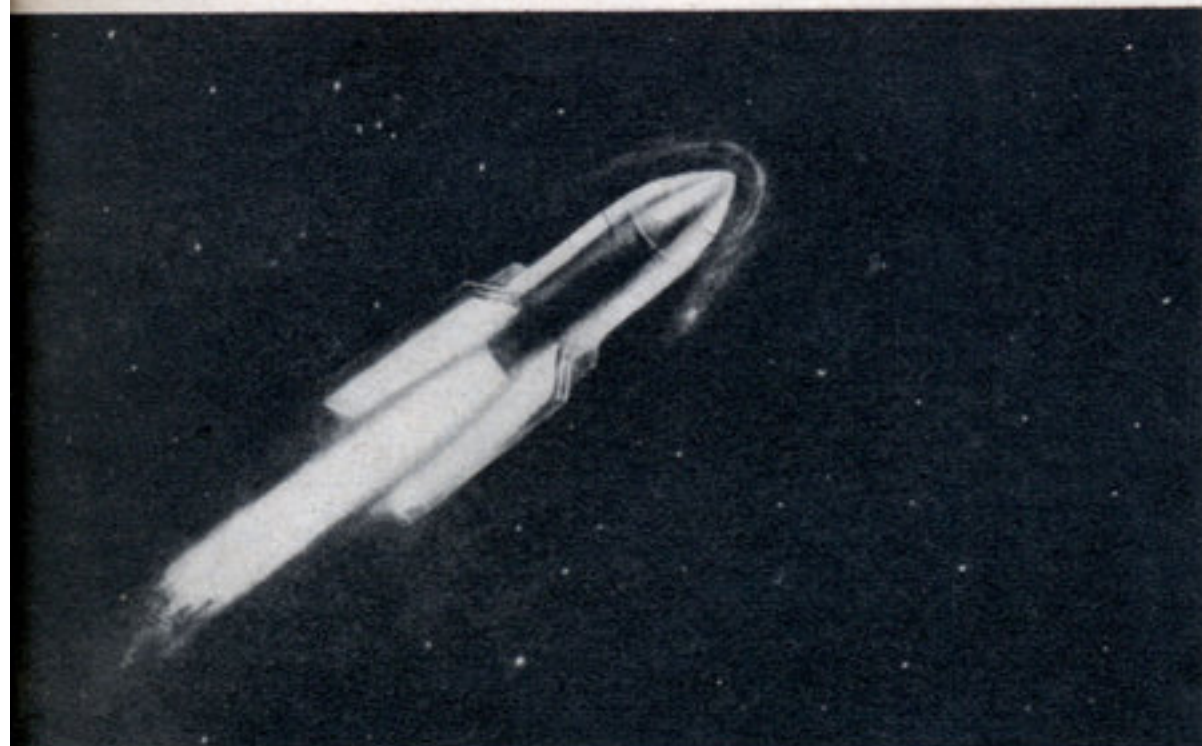
In considering the dangers of space travel by rocket, we shall have to content ourselves with those which we know to exist; others may be present, but we have no way of determining them now.

One known danger comes from the short radiations, ultra-violet and shorter, of the sun and meteorites. The metal hull of the ship will protect the crew from all the short radiations. The weak points are the windows. It is significant that all the "early" books about the problem, those written between 1925 and 1930, are evasive about that question. I was once asked about it after a lecture and I had to reply that one would have to wait for favorable developments in that respect.

In the meantime these favorable developments have taken place. High-altitude flying has taught a number of valuable lessons and has stimulated chemical research to solve the problem.

In the first place, glass has been replaced by transparent plastics which are far superior mechanically. But the customary transparent plastics list it as one of their advantages that they do *not* shut out ultra-violet rays. This is an advantage at and near sea level, where the dosage is small. But in high altitudes, where the thickest part of the atmospheric blanket is lacking, there is far too much ultra-violet for good health. It did not take long, after this was realized, to develop a special type of transparent plastic which is almost opaque to ultra-violet without impeding the passage of visible radiations. For use in open space even this new compound is not opaque enough, but the quick, partial solution of the problem indicates that a full solution is possible.

The danger from meteorites is far more substantial and cannot be combatted in so



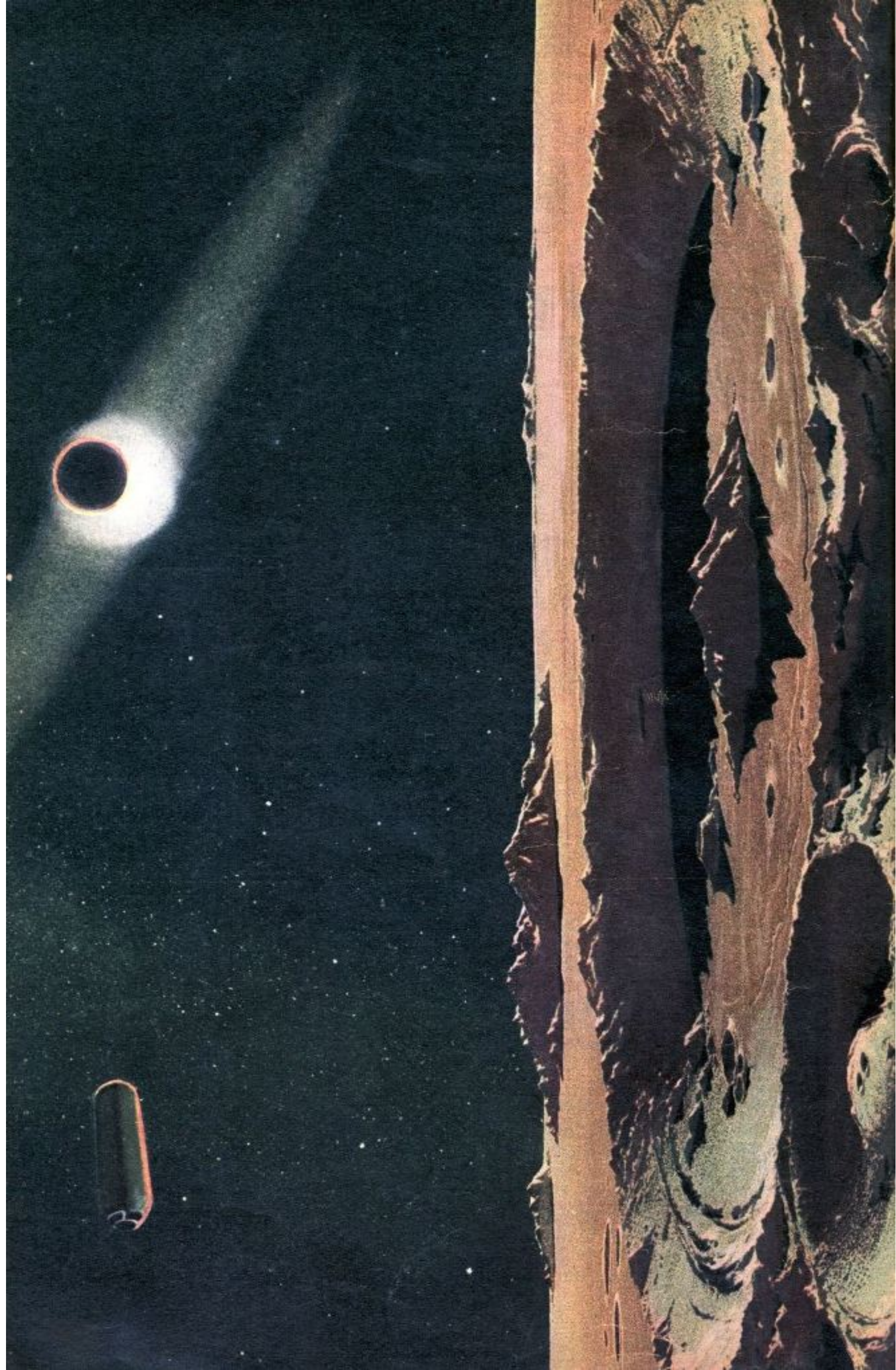
Ship appearing in same film is shown on its meteoric flight through the vacuum of space. Oberth's model of it was seized by German Gestapo.

way, a mass-ratio of 26 to 1 (26 pounds of take-off weight for every pound that gets to the moon) might be accomplished.

At first glance the result of this rocket discussion may look as disappointing as the result of the gun discussion in the preceding article. But there is an enormous difference. The gun discussion ended up with the realization that it was simply impossible to build such a gun, that no trick of advanced engineering and no amount of experimentation could help.

In the rocket discussion we arrived at some definite figures. Find a fuel that has an exhaust velocity of about 5,500 yards per second and then find a way of building a rocket with a mass-ratio of 26 to 1. Or the other way round, find the way of building such a rocket first and then go about finding such a fuel. As for the fuel, hydrogen with liquid ozone may turn the trick. As for the design, a combination of two rockets may be expected to produce such a mass-ratio.

To sum up: while the rocket to the moon cannot be accomplished now, we know in which direction engineering research will



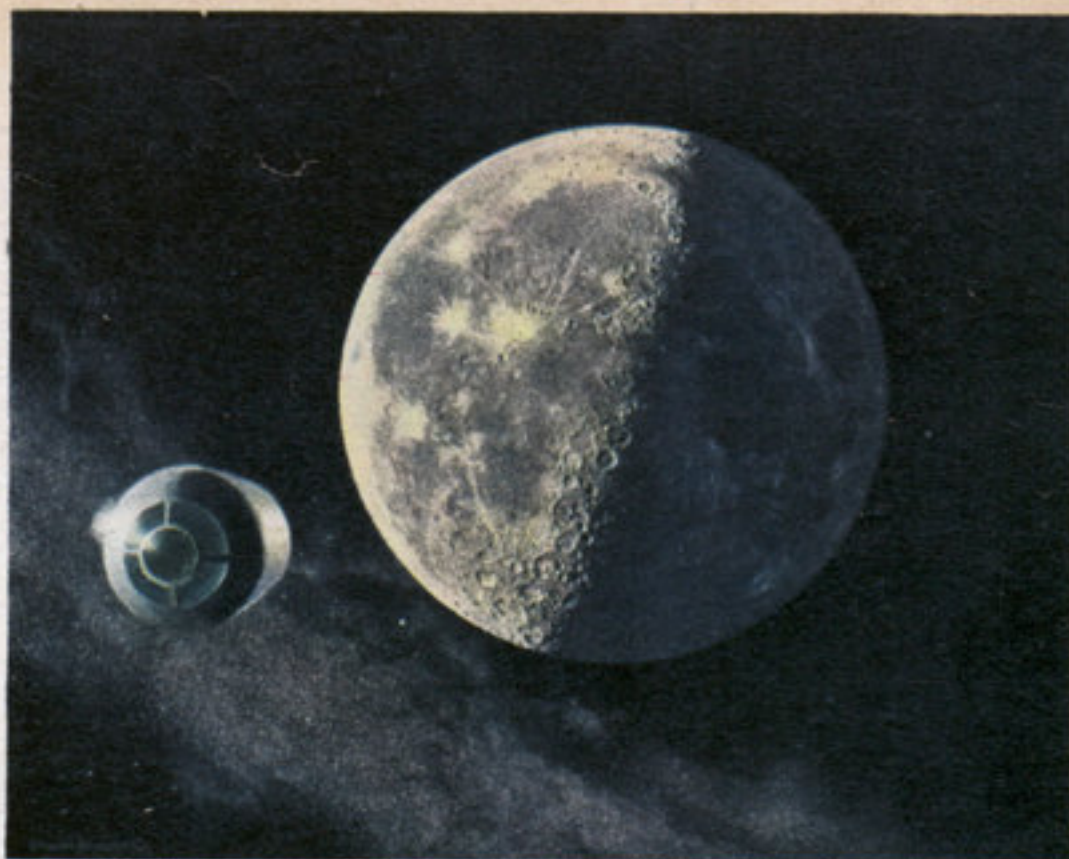
easy a manner as the ultra-violet. In fact there is little that can be done about meteorites at all. Detection of a large meteorite might be possible by a radar-type instrument, but it would probably miss the small and much more numerous meteorites.

Even if the instrument did not miss them, the detection would not be of any help. Detection does not mean that the orbit of the meteorite has been established. It would be a major job to find out whether the orbits of the meteorite and of the ship intersect at a point where both will be at the same time.

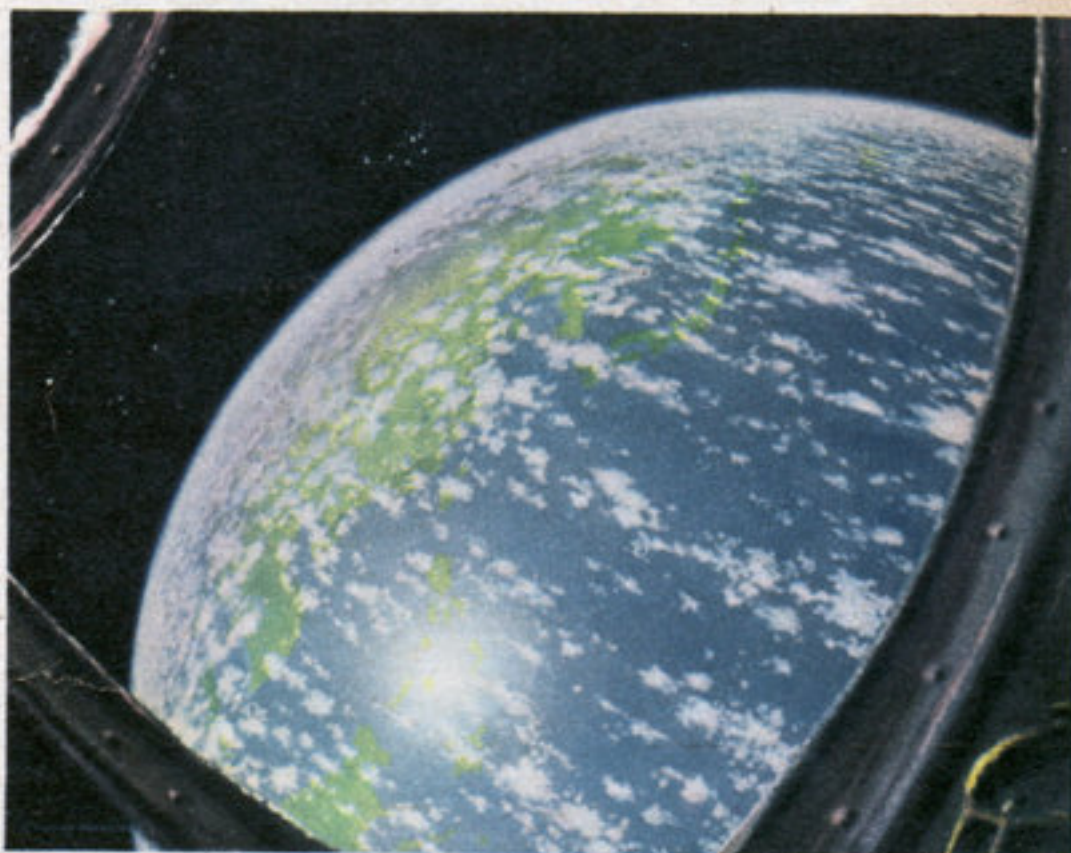
No doubt there is a danger factor there and all we can do is to estimate the probable frequency of such an event. The earth, astronomers estimate, is hit by some two million meteorites every twenty-four hours. The vast majority of them burn up in the atmosphere; an average of two out of the two million reach the ground. To a spaceship, even the small ones would constitute a danger, but that figure cannot be applied to a spaceship as some critical authors have done in the past. The earth presents a target several thousand billion times as large as the largest conceivable ship. And although most meteorites do not so much fall onto the earth as they run into it or the earth runs into them, the gravity of our planet plays a role too. This second factor is missing completely in the case of a ship.

The figure given for the earth is, therefore, only misleading and should be discarded. But another way of estimating the danger can be tried.

Making some unfavorable assumptions, one can calculate that we would have to send about five hundred thousand rockets around the moon to be sure that one of them would be hit by a meteorite. The danger factor, it may safely be concluded, is quite small.



Rocket ship is returning to earth; it is about 5,000 miles out from moon. Dark side of moon is never visible to earth.



We are 5,800 miles out and falling toward earth's surface; cloud blanket is clearly visible. Philippines are at bright spot.

However, it does exist, and it is the only danger that is not due mostly to the imagination. But since when do we live in an age where no ship is ever wrecked in a storm, no railroad train ever suffers an accident, and no airplane ever crashes?

If a meteorite did hit the passenger cabin of a ship, it would pass through the metal walls—probably consisting of an aluminum-beryllium alloy—as easily as a high velocity rifle bullet passes through an empty cardboard box. Still this does not necessarily

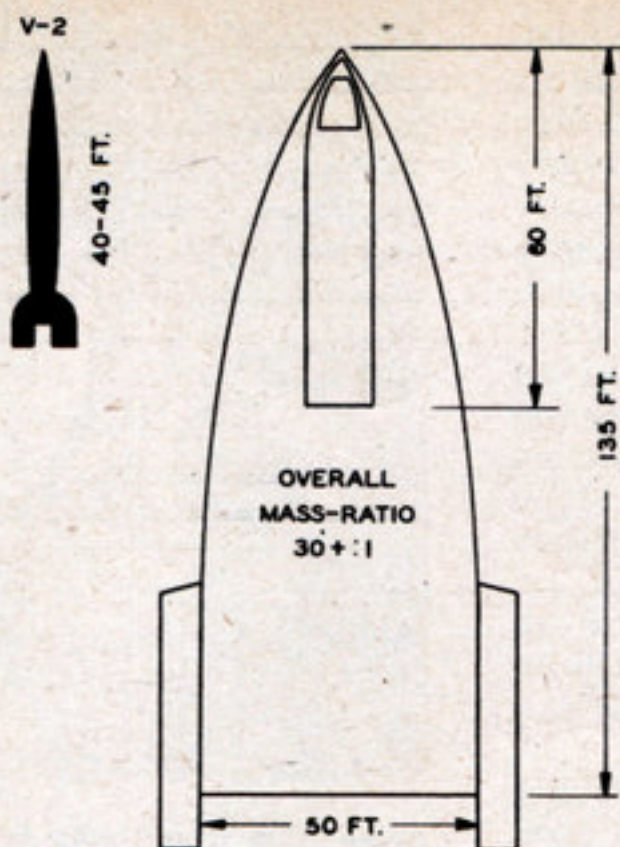


Sun's eclipse by earth as it appears from the moon. Earth looks four times as large as the moon looks to us from position on earth.

mean the death of the whole crew. Because of its rapid passage, the meteorite would produce two holes of exactly the same size as its own diameter. Naturally the air would escape through these holes, but it would not happen instantaneously. In fact the drop in air pressure would be the first warning sign.

Now we get into a whole complex of questions. The mechanical part is relatively simple. If the walls of the cabin are comparatively bare, as they should be, the holes will not be too difficult to locate. A small patch of sheet rubber would close the hole; the air pressure in the cabin itself would hold the patch in place until a real repair job could be undertaken. But such an event has physiological implications. Supposing that the air pressure drops to half its normal amount between the accident and emergency repair with small slabs of rubber. There would still be air enough left for breathing (uncomfortable breathing), but the rapid decompression might have serious consequences. The occupants might come down with a case of "diver's sickness," commonly called "bends."

"Bends" is caused by rapid decompression of any description, but the real cause may be described as "bubbles in the blood," nitrogen bubbles, to be precise. The nitrogen of the atmosphere has the habit of dissolving in the tissues and in the blood. As long as the pressure stays normal this saturation with nitrogen is of no consequence whatever. But when the pressure is released, or better, relaxed, the nitrogen emerges and forms the dangerous bubbles constituting the cause of the bends. Elaborate



Comparison of our rocket ship with V-2. The fuel shell is dropped when empty.

tests have shown that the bends might be avoided if the body is saturated with oxygen for a period of time before the decompression occurs. Unfortunately the "period of time" is long, at least five hours, and breathing too much oxygen is not at all healthy, either. But there exists another and better substitute for nitrogen: helium.

Helium, chemically even more inert than nitrogen, does dissolve in the body to a certain extent, but it is much less soluble than oxygen, roughly one-fifth.

Conversely, the process of bubble formation under decompression is much milder; in fact it needs an extreme case to occur to a health-impairing extent. Diving tests with rapid ascent have shown that experienced divers at least, emerging in a helium-oxygen atmosphere, can sustain decompressions which would have killed them if the atmosphere had been a nitrogen-oxygen mixture. It becomes clear, then, that the atmosphere inside a spaceship cabin should be a helium-oxygen instead of a nitrogen-oxygen mixture.

This again is a point where recent developments evolved for high-altitude flying permit us to say more than could be said ten years ago. Supposing the meteorite which pierced the cabin were very small, so that

the holes it made were like pinpricks? Air would escape slowly through these holes and the decompression would be so slight that it might pass unnoticed for a long time. A great deal of oxygen atmosphere could be lost in this way.

A small gadget, worn in the ear, answers this problem. The gadget operates by sending a small beam of [Continued on page 148]

Chesley Bonestell, creator of the color paintings on these pages, is a noted Hollywood artist specializing in educational material. For his unique work shown here, he has collaborated closely with Willy Ley, the author, and Mt. Wilson Observatory.

An aerial photograph of Earth from space, showing the New England coast. The land is green and brown, with a network of rivers and lakes. The ocean is a deep blue. A large, dark, curved object, likely a satellite or spacecraft, is visible in the foreground, partially obscuring the view of the coast. The image is oriented horizontally on the page.

On our return journey we are 600 miles from the earth looking down at New England coast.

ROCKET TRAVEL THROUGH SPACE

(The following is by Professor A. M. Low, President of the British Interplanetary Society, inventor of many rocket devices. During the First World War he was in charge of Britain's Royal Flying Corps Experimental Works, where he designed and built the first radio-controlled robot aircraft.)

THE British Interplanetary Society was founded in 1933 with the express aim of promoting and facilitating research into all problems associated with space travel.

The research program up till the time of the war consisted of detailed theoretical study of a test case: the requirements of a vessel capable of transporting a scientific expedition to the moon, with provision for its return; the design and construction of demonstration models of navigational instruments for special purposes; and experimental examination of fuel combinations.

Up to now, much of the Society's work has been in original research and in the analysis of experiments made during early rocket tests—the work of Opel and his car, of Professor Oberth, Mr. Pendray, Grindell-Matthews, and of that very brilliant authority, P. E. Cleator. Opel, by the way, was well known in Britain for his 100 m.p.h. rocket-driven car demonstrated near Berlin in 1928. In an early experiment with a car resting upon rails, a cat took the place of the driver, but after a journey of approximately three quarters of a mile, most of the powder-charged rockets ignited simultaneously. The car, the rails, the cat and quite a large quantity of earth have not yet been found!

Among early experiments in Britain a rocket was fired from the mainland in an attempt to carry mails to the Isle of Wight—a distance of only a few miles. The rocket, however, acted like the first robot; it flew back towards the more venturesome onlookers, and virtually exploded

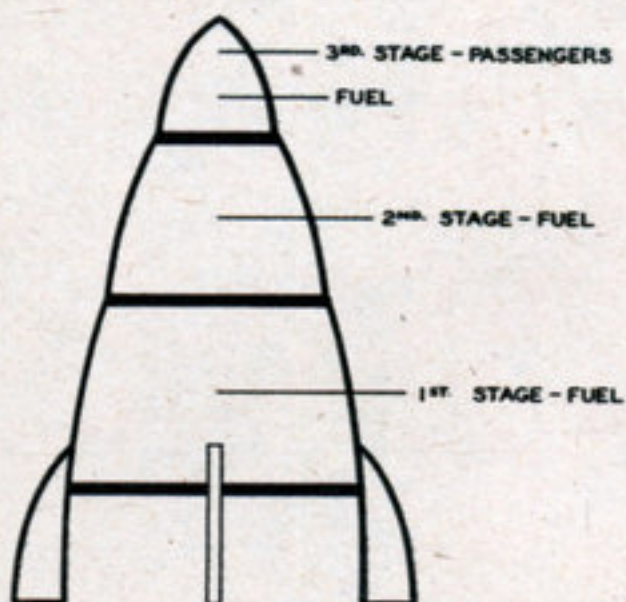
before it reached the ground to strew its letters like leaves before the gale. The failure was due to poor fuel.

Rocket fuel has been the subject of innumerable tests. The liquid oxygen and hydrocarbon type is by no means new, but only recently has liquid oxygen become commercial. It may yet give us the clue to many new explosives and, more important, to entirely different methods of high-speed travel. Most of these original oxygen experiments were made with gasoline, but this was discarded during the early experiments made by the German Rocket Society in favor of alcohol which can, of course, be mixed with oxygen without difficulty. The first powdered fuel tests, using tubes packed with gunpowder, were largely unsuccessful, which perhaps accounts for the failure to realize that the original work by these rocket societies is responsible to a great extent for the present-day military rocket-shell.

Military rockets are one of the most important technical advances of the day, but they are relatively small although their horse-power must be several hundreds of thousands. To deal with thousands of tons of fuel is a vastly greater problem and implies that the cost of any space travel ship is likely to reach several millions. The first experiments will doubtless be made with relatively small rockets, carrying some means of signalling which could be observed from the earth. As far as man-carrying rockets are concerned, the difficulties of control and of violent acceleration necessary to attain a speed which would carry the vessel from the earth's gravitational field have been greatly simplified by the development of liquid fuels.

High speeds are necessary not only on account of the vast distances to be traversed, but also because a rocket is only thermally efficient at high speeds. The problems to be encountered are tremendous. In the first place, the ship itself when approaching

*[Continued on
page 146]*

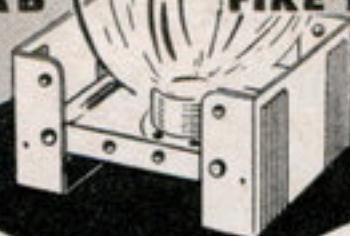


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Professor Low's space ship is three-stage with two extra fuel shells. Passengers ride in nose.

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Rocket Travel Through Space

[Continued from page 81]

the halfway distance between earth and moon would be under conditions of "no gravity." It has already been proposed that a slight rotary motion should be given to the ship in order that centrifugal force may enable the occupants to live without magnetic shoes or other queer accessories.

The difficulties of excessive heat from the sun's rays are probably easily overcome by the use of reflecting surfaces, while the hitherto insuperable difficulty of starting at rest to reach a possible speed of 25,000 miles per hour in eight minutes has now been found to be far less serious than was originally thought. Tests have been made in Germany by means of centrifugal machines which demonstrated that this acceleration can comfortably be withstood by human beings, and further detailed observations and plottings have proved that the greatest danger of all, that of meteorites, is likely to be less troublesome than the risk of crossing an ordinary roadway. The insurance rates would only approximate one in one million.

Within 50 years new fuels—I do not suggest atomic power—will be of incomparably greater value to the space ship than anything which we know at present. Enthusiasts in the science of astronautics should find it easy to answer the inevitable question: What would be the use if it should succeed? I always remember the well-known story of Faraday to whom, with his electric spark, has been due every piece of electric apparatus in the world. Asked after his lecture at the Royal Society, "What is the use of it, Mr. Faraday?", he replied, "Of what use is a new-born baby?"

Military rockets can be of immense value in peace-time. They will help us to learn about high-speed flying, they could be used for postal work, and as an immediate outlet they can tell us more about the upper atmosphere, or stratosphere, than has been learned during the past half-century. By a detailed and accurate knowledge of the lower stratosphere we may be able to forecast weather for many weeks ahead, information which would change meteorology from guesswork to a useful and proper science. The world at present knows next to nothing about cosmic rays. The rocket may take its place with the cathode ray microscope as one of the most important "weapons" the physicist has ever possessed.

Your Invention Clinic

[Continued from page 12]

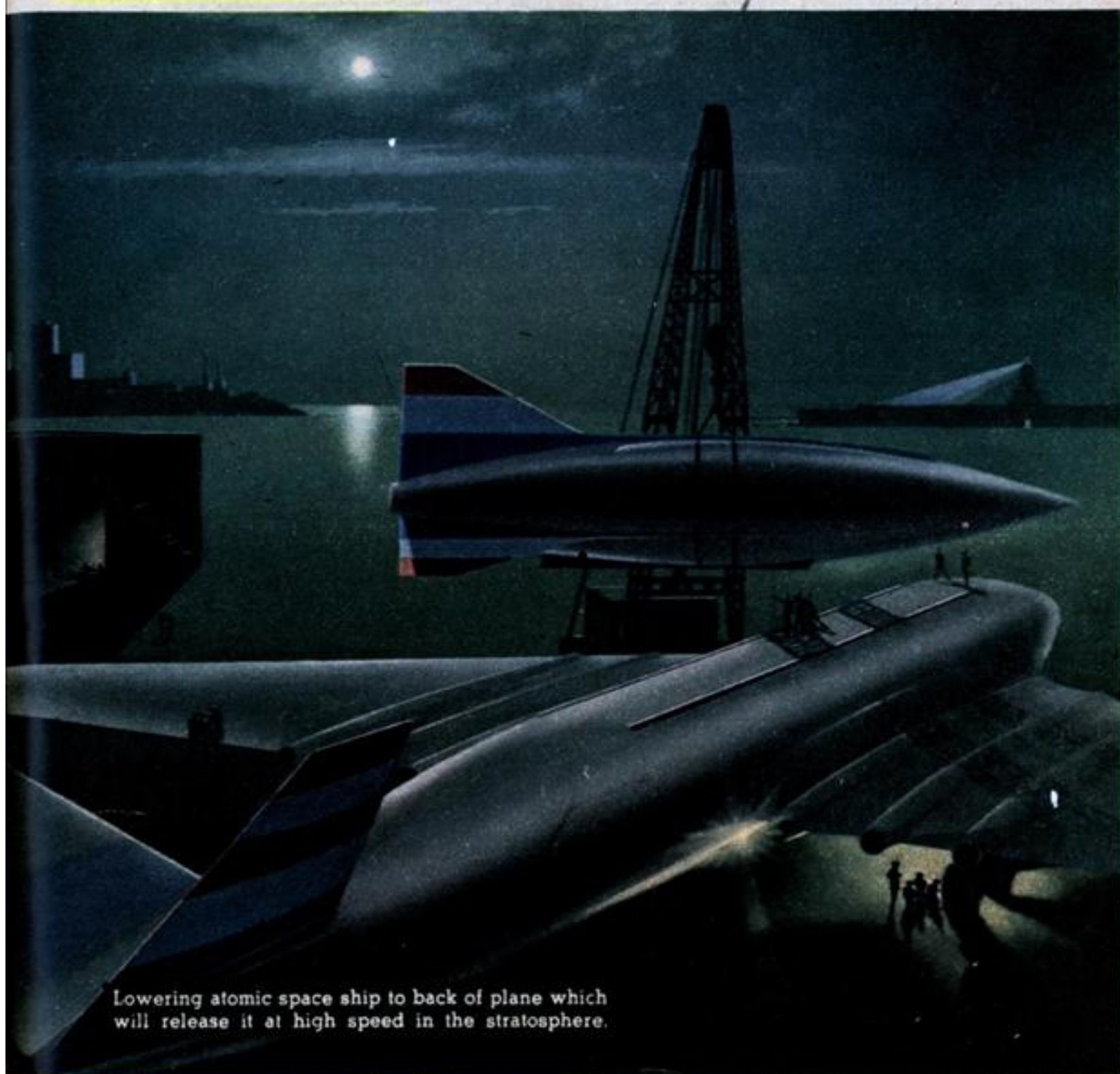
If you want further information about listing your patent for sale or for license, write to the Commissioner of Patents, U. S. Patent Office, Washington, D. C.

More than 200,000 different chemical compounds have been made from the dozen or more hydrocarbons found in coal tar.

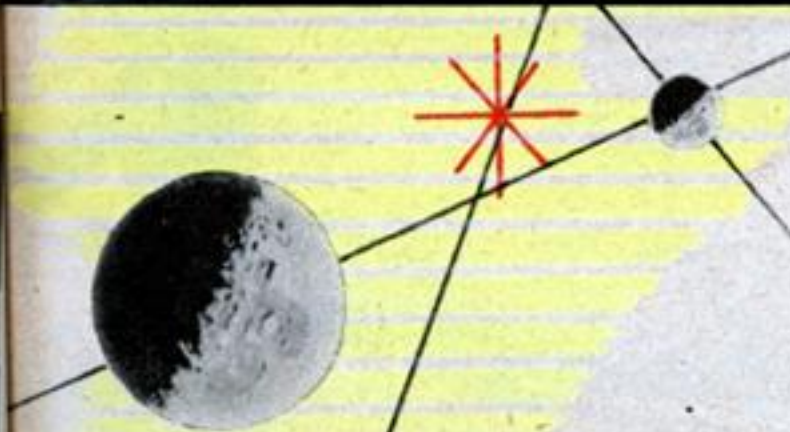


race to the planets

BY WILLY LEY



Lowering atomic space ship to back of plane which will release it at high speed in the stratosphere.



It won't be long! Earthmen are fast removing all obstacles to the conquest of interplanetary space.

EARTHMEN have set their thoughts on the conquest of space. More than that, they have set their hands to it. In dead earnest they are committed, in both the Old World and the New. It now can definitely be said, the race to the planets is on!

Most experts are agreed that the first unmanned guided missile will strike the Moon some day during the next ten years. The first manned Moon rocket will probably follow within five years after that. But that trip will not include a landing; it will be merely a trip around the Moon,

at a comparatively close but respectful distance, with return to Earth after circling it a few times.

The best rocket fuels known at the present time will not allow more than that. Even a landing on the Moon with subsequent return to Earth seems to be somewhat beyond the reach of chemical fuels. It might be explained that the simplest way of expressing the value of a chemical fuel is to name the exhaust velocity which it will produce. The largest known rocket motors burn alcohol with liquid oxygen, and their exhaust velocity is about 7,000 feet per second.

Considering that sound moves through air at the rate of about 1,000 feet per second, this is quite a high figure, though it is only about half the theoretical exhaust velocity of that combination. If you wanted to go only to the Moon, land there, do some preliminary surveying and research, take off again and return to Earth, you would need a ship which carries some 20,000 times as much fuel as its own dead weight.

That, of course, is impossible.

But there are a few more powerful chemical fuels. Let's jump across the pages of the handbook of chemistry and look at once at the most powerful usable combination known to chemists—hydrogen burned with ozone instead of oxygen. This has a theoretical exhaust velocity of 18,500 feet per second. Actually an exhaust velocity of about 12,000 feet could be obtained if scientists and engineers knew how to handle that combination, which they don't at present. Supposing they do learn, the space ship which is to land on the Moon and return to Earth still would have to carry a fuel load of about 150 times its dead

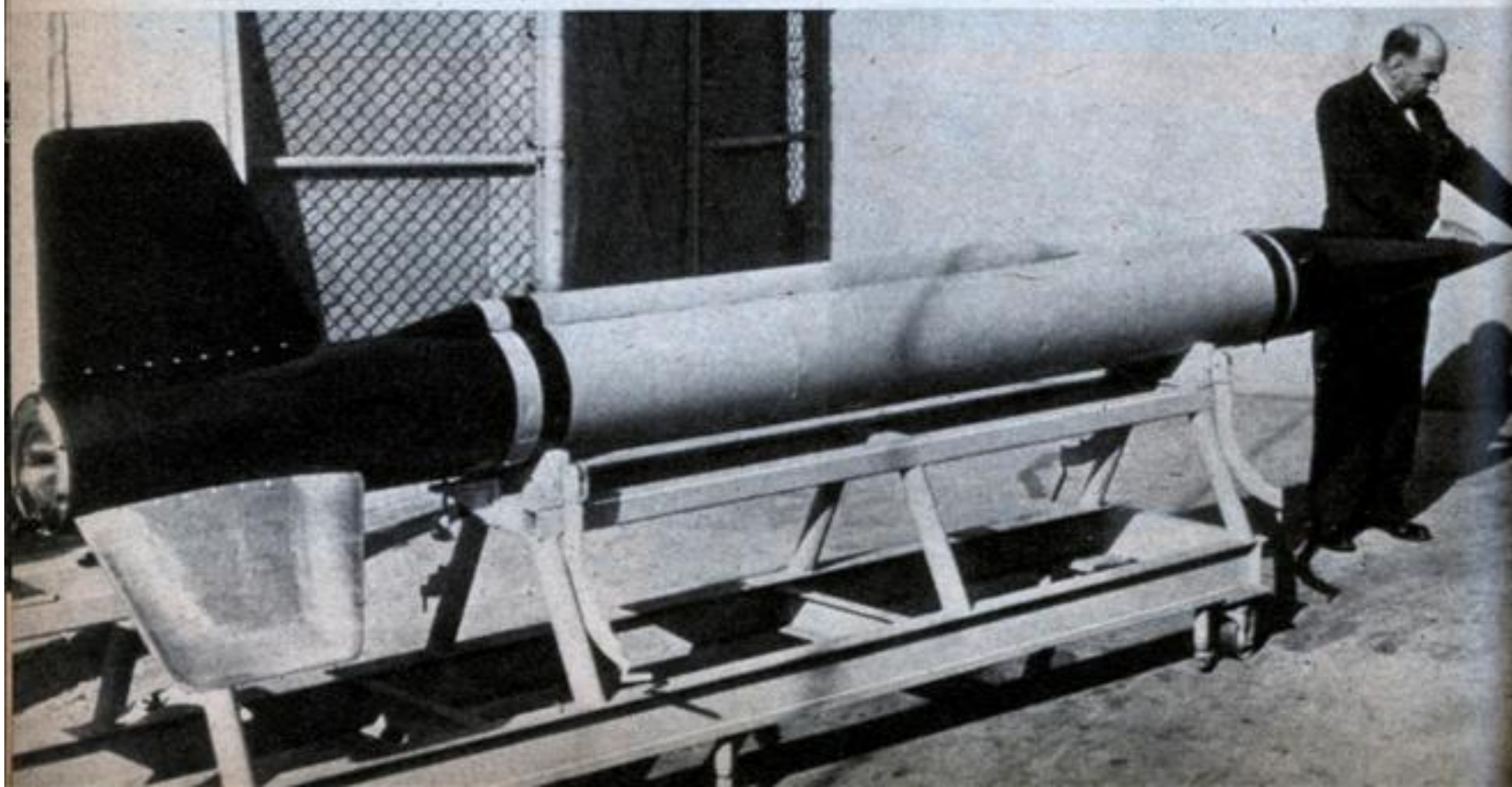
weight, and that is impossible, too.

Though this sounds gloomy, it probably isn't very important. For the chances are that the engineers will never learn how to handle the hydrogen-ozone combination in a space ship, but that by the time the first chemically-driven guided missile crashes on the Moon, we'll probably have the first rockets propelled by atomic energy.

In July 1946 a new project was quietly started at Oak Ridge. Its name is NEPA, from Nuclear Energy for Propulsion of Aircraft. The purpose of the project is to investigate how atomic energy can be utilized for the propulsion of aircraft and rockets. No outsider knows right now how it can be done and it is quite probable that the insiders, at this moment, are not too sure, either. But in time they will emerge with an answer.

One principle of that answer is clear even now. A rocket operates by burning a fuel with oxygen and by expelling the products of combustion. A nuclear energy rocket could not do that; it would not be allowed to consume valuable uranium or plutonium and throw out the fission products. These products would be fantastically fast, but they'd be too light in weight, and therefore inefficient. An atomic rocket would need something else to throw away, a kind of "filler mass." Rear Admiral William S. Parsons stated recently that this filler mass could be hydrogen gas.

The hydrogen gas, he said, would not be "burned" as a fuel, it would just be heated to very high temperatures by atomic energy—say something resembling, or rather derived from, a high-intensity pile—and expelled through the exhaust nozzles. Hydrogen is advan-



tageous for this purpose from every point of view. The lighter the molecules of the exhaust gas, the better it lends itself to a high exhaust velocity. Hydrogen has the lightest molecule that exists. Hydrogen is also cheap and plentiful—being one of the main constituents of water—and if one has the necessary machinery for producing very low temperatures it can readily be liquefied and in that state is easy to handle.



A spherical space ship has been designed by Mr. Warnett Kennedy, English inventor, seen examining a small prototype (above). He finds streamlining unnecessary—for the atom gives such power that the ship need not take off at violent speed.

A new American altitude record of 230,000 feet—43.5 miles—was set by the new ionosphere rocket (left) developed at California Tech with the help of Douglas Aircraft engineers. It has a parachute attachment which brings it safely back to Earth.

Space travel so definitely lies just ahead that one man, Dr. Samuel Herrick (right), astronomer of the University of California, already is conducting a university course in rocket navigation. How many of his ten students will set foot on Mars?

July, 1947

Supposing that the atomic engine is capable of expelling the hydrogen gas with a velocity of 65,000 feet per second (nine times as fast as the exhaust of a V-2 rocket), the moonship will need carry only about 2.5 times as much fuel as its own dead weight. The V-2 rocket now carries a little more than 3 times as much fuel as its own empty weight. This means that the moonship can be built without special difficulties, once the gentlemen of NEPA find a method of handling atomic energy for this purpose. And—it must be added—once they solve the difficult problem of protecting the travellers from the radiation which emanates from the atomic engine.

Since the mass which is thrown out of the exhaust nozzles is hydrogen, that moonship could also go to Mars and back, provided that water can be found somewhere on the Moon. Astronomers do not like to commit themselves on this point, but most of them seem inclined to grant the probability of water existing somewhere on the Moon, in the form of ice, of course. A well-stocked refuelling station for atomic space ships will carry slugs or bars of plutonium-rich uranium (carefully stored so as to be below critical mass), liquid hydrogen for the rocket nozzles to throw away, liquid oxygen for the travellers to breathe, and some minor items such as vitamin pills and frozen food.

But if there is no well-equipped refuelling station, any body of water will do. In that case the ship will have to carry the necessary equip-



ment for electrolysis of water, resulting in gaseous oxygen and gaseous hydrogen, and the equipment for liquefying these gases. The atomic powerplant can provide the necessary energy for these operations, while the low temperatures of the lunar night will make the job of liquefaction easier than it is here on Earth.

Before we go on let's have a look at the solar system, just as any traveller on Earth would have a look at the map before he sets out on a trip. We need to, much more than the surface traveller. Any island, however remote, to which he might want to travel, at least stays in one place—but our planets do not stay in one place.

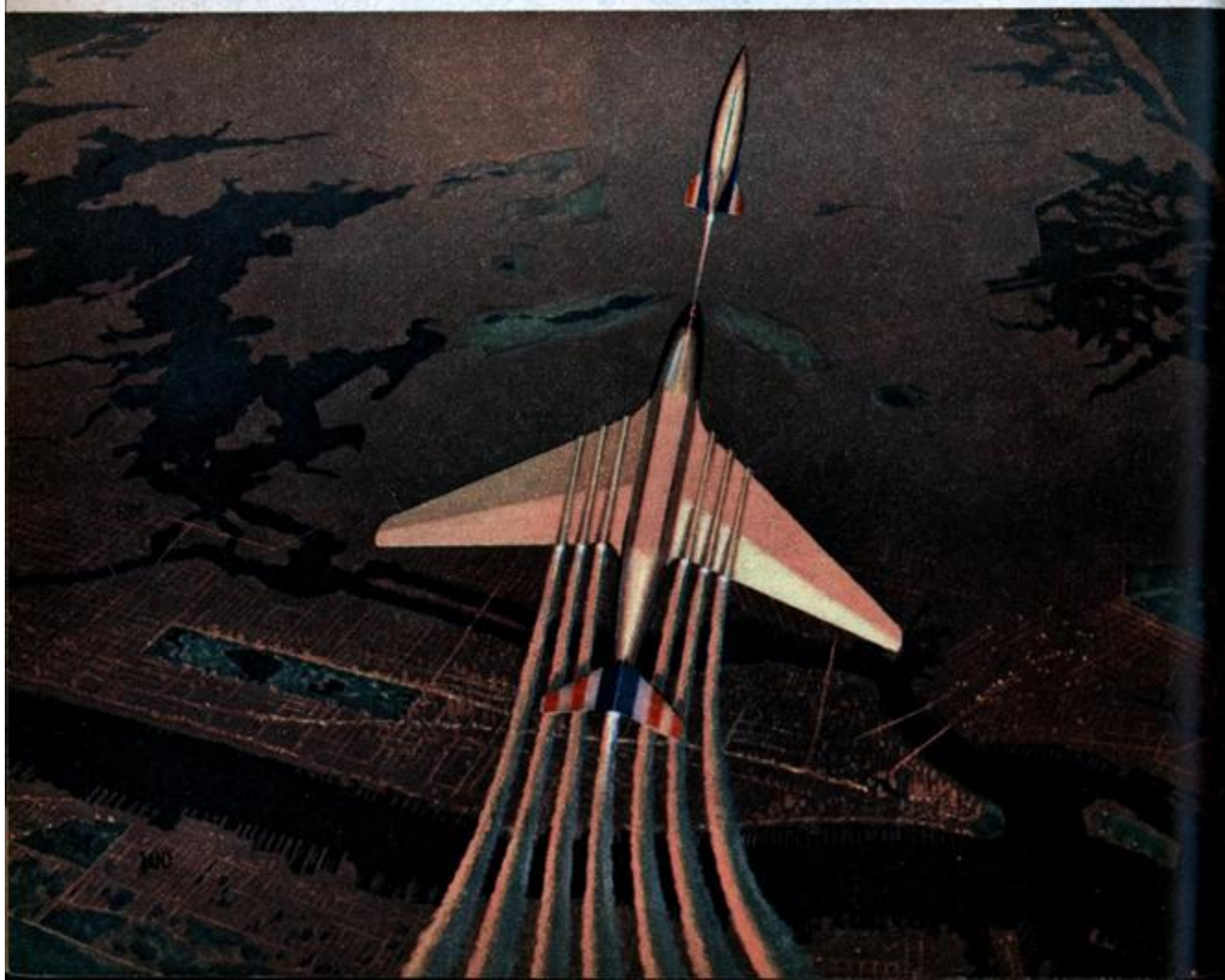
The case of the Moon is easy, for it moves along with and around the Earth in space. It would be possible to set out for the Moon at any moment. Things are slightly more complicated than they may seem at first glance, but the pilot of a space ship bound for the Moon does have the enormous advantage that he can see his target all the time. The navigator who is bound for Pitcairn Island is not as well off.

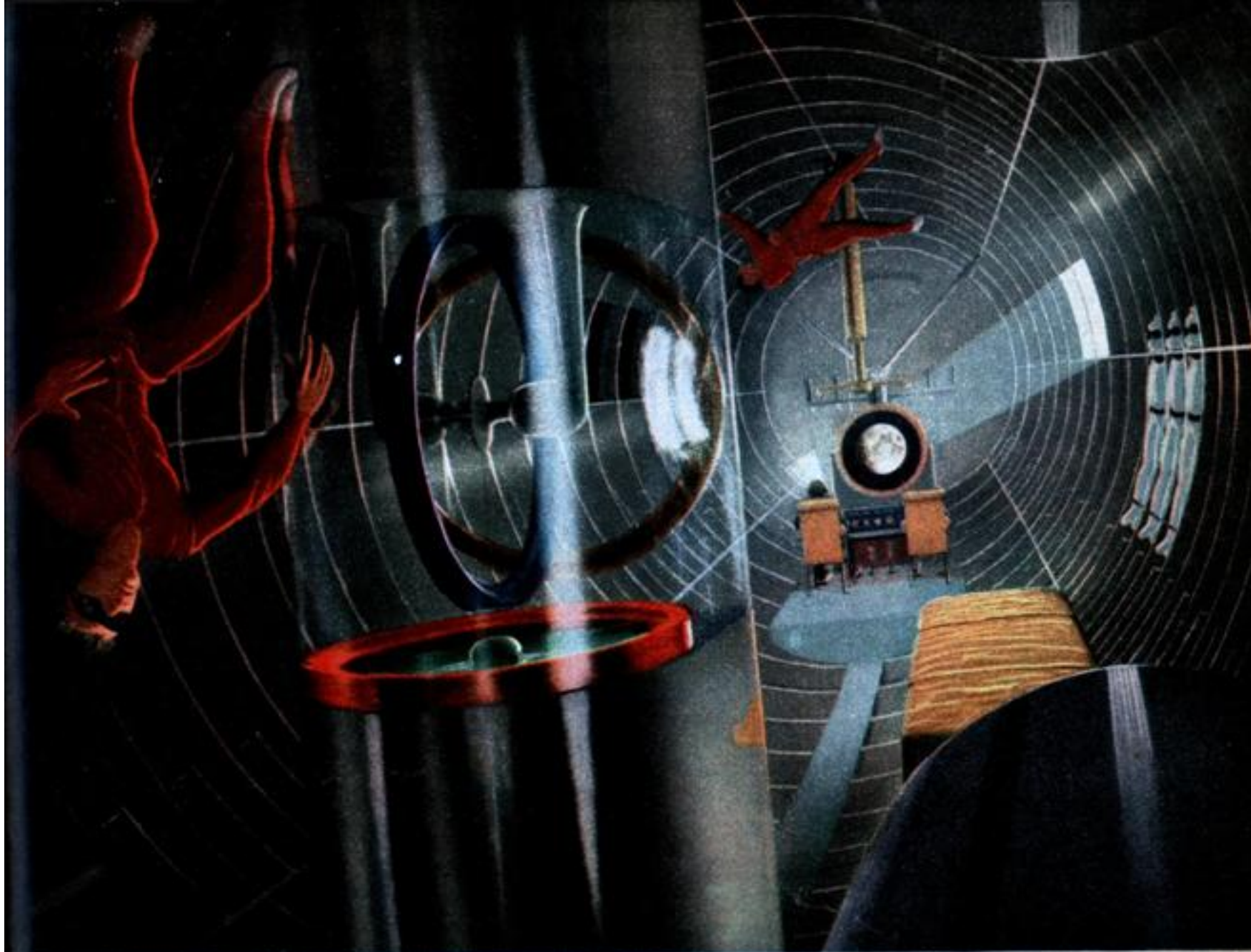
But if the ship is going to Mars things are different. All the planets move around the sun—fortunately all in the same direction and all about in the same plane—but

they do not move with equal speeds. Mercury, innermost of the planets, is the fastest by far. Venus, which is next in line, is somewhat slower, Earth, which comes next, is still slower, and Mars, outside the orbit of Earth, is again slower. They all move in ellipses, with the sun in one focal point. The space ship also has to move in an ellipse with the sun in one focal point; but the ellipses which are the orbits of the planets are nearly circular, while that of the space ship orbit will be elongated—elongated enough to touch the orbit of Earth at one end and that of Mars at the other.

Of course you can get a space ship into such an orbit any day you please, but that's not enough. You don't just want to touch the orbit of Mars, you want to touch the planet Mars at some predetermined point in its orbit. It's somewhat like trying to meet a fleet which is going ahead under full steam. Your only advantage is that you know the planet's course and speed; astronomers can tell for any hour for many years to come just where Mars is going to be.

At 50,000 feet, speeding at 500 mph, the Moon-bound space ship leaves the back of the carrier plane. Its rockets thunder. It is on its own!





But we are getting ahead of the story. First the ship has to take off from Earth. It might be able to take off directly, but this would be impractical. The exhaust of an atomic-powered ship might be radioactive and therefore highly dangerous to the spectators; it certainly would be inefficient. The efficiency of a rocket motor increases as the speed of the rocket increases. In a space ship powered by nuclear energy the inefficiency would be really bad, just because it has such a high exhaust velocity.

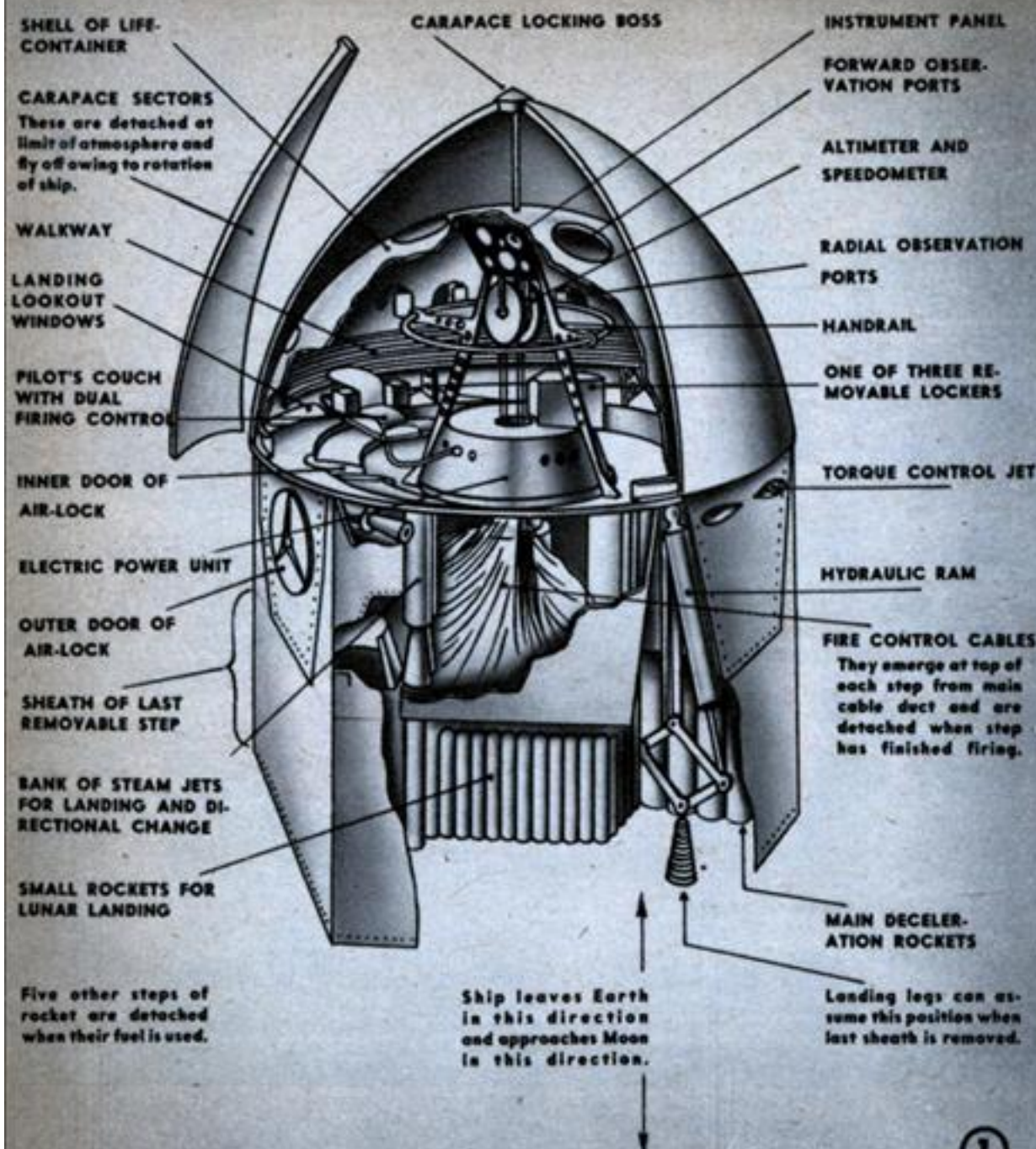
For these reasons it will be practical to carry the ship to a high altitude, say 50,000 feet, and there bring it up to a speed of some 450 or 500 miles per hour. More would be better, but that is about all one can get from a large jet-propelled carrier plane. At the highest altitude at which the carrier plane can fly at high speed, the rocket will separate from it—the plane getting out of the neighborhood of the dangerous radioactive exhaust blast as fast as possible.

The exhaust will appear as a flame, for two reasons. The hydrogen gas will be heated to incandescence and look like a lance of light merely because it will be so

Interior during the "free flight" period of trip, when travel is by momentum only. The crew seem no longer to be subject to the law of gravity!

hot. And the hot hydrogen will unite with the oxygen of the air and burn in the chemical sense. This will add precisely nothing to the propulsive power of the rocket, but it certainly will increase the spectacle, especially when seen against a night sky.

The first job of the free ship will be to get out of the atmosphere which impedes its movement; therefore its nose will be pointed upward vertically or almost vertically at first, until it reaches a height of 80 miles or so, then it will be slowly depressed until the longitudinal axis is almost horizontal. This—for difficult mathematical reasons—is the most efficient method of getting a space ship up to full speed. The result is a curve which has been named the synergy curve; it points east for highest efficiency in take-off. Once the ship has attained a velocity of 5 miles per second it cannot fall back any more. If necessary it could make a half circle around the Earth in order to point at the place in the sky where the Moon is due to arrive some



①

The main compartment of a chemical-fueled space ship. One by one, five rocket steps, not shown, will be detached when their fuel is used up.

②

Cross section of large disk of "living wheel" showing crew inclined radially under the artificial gravity resulting from its rapid rotation.

③

The living wheel's auxiliary powerhouse. The parabolic mirror focuses the intensely hot sunrays on the knob of pipes, generating steam.

④

Section along axis of space station showing living quarters in outer ring, parabolic mirror, steam pipes and revolving entrance lock.

AUTHOR. Willy Ley has been identified with rocket research for 20 years. He has built rockets, launched them, and written about them, both learnedly and popularly, in treatises, magazines and—especially—his most recent book, "Rockets and Space Travel," just published by the Viking Press. When he tells us that man is soon to embark on that last and greatest adventure of all, the exploration of the solar system, both scientists and laymen listen with respect.

ARTIST. Chesley Bonestell, who has done the color paintings on these pages, is a Hollywood artist noted for combining the rich imagination of the artist with the down-to-earth mind of the scientist. In his space creations he has worked in close collaboration with the author, Mr. Ley, and scientists of Mt. Wilson Observatory.



90 hours later. That would not take any fuel; but for many reasons the time of take-off would be so chosen that the synergy curve points in the right direction.

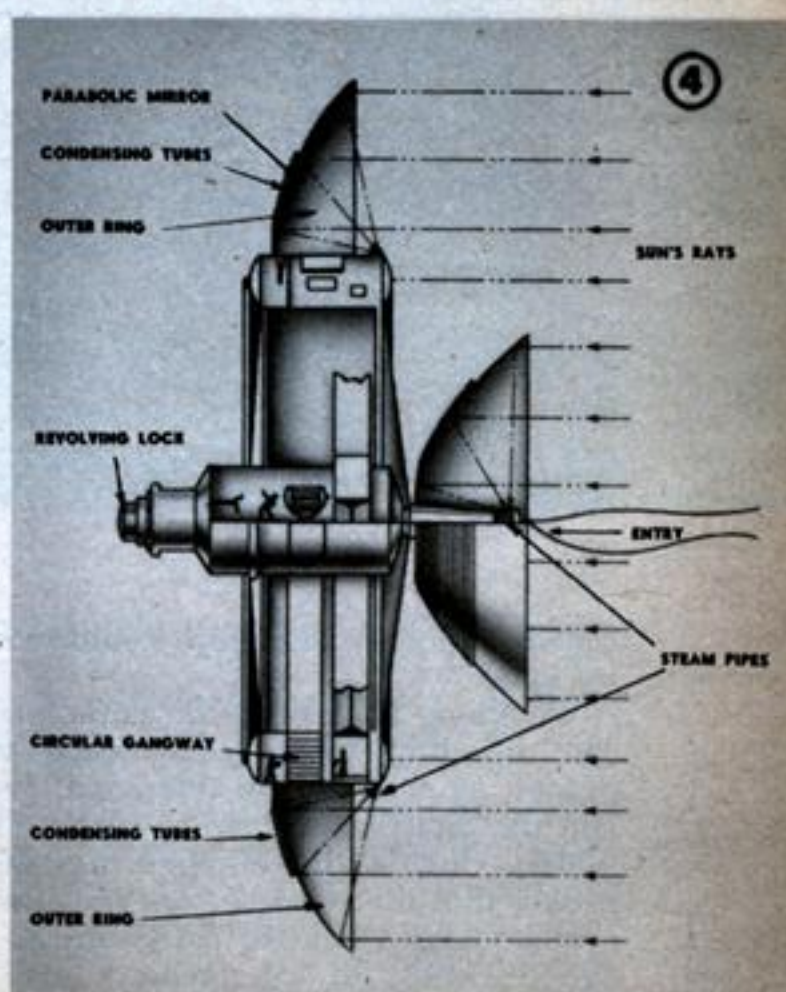
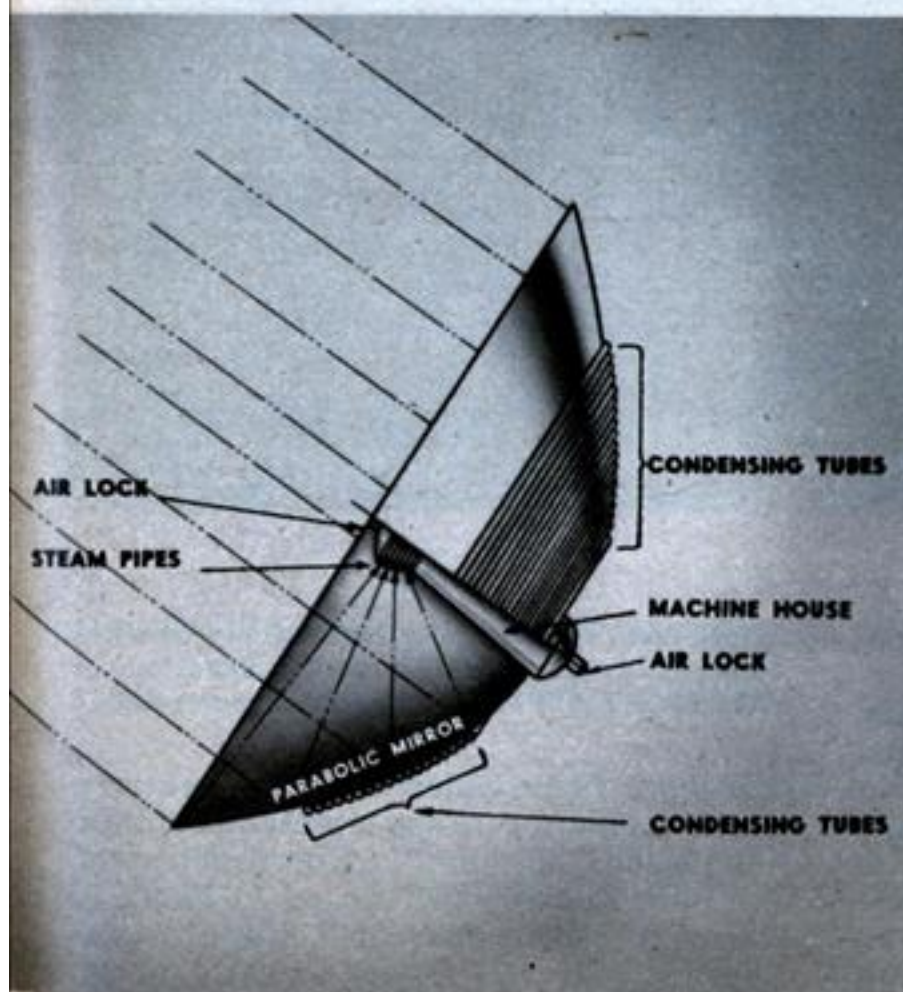
Experiments with centrifuges have proved that a normal man with a sound heart can stand ten minutes of an acceleration of four gravities. The atom-powered ship will need only about eight minutes of such acceleration to have all the speed it needs to get to the Moon. It need only throw out a little more than $2\frac{1}{2}$ times its own unfuelled weight of hydrogen gas, then it will not need active propulsion any more; its momentum will carry it to and across the line where the gravitational attraction of Moon and Earth balance each other; and from then on it will fall to the Moon, because of the Moon's attraction, and it will have to resume power only to brake its fall and land.

The spot for landing is one chosen because it is either known or at least suspected that there is water in the vicinity. If there is none, there will be enough hydrogen left in the tanks to return to Earth—a relatively simple matter because the Moon does not have the terrific gravity of our home planet. If there is water the tanks can be replenished with liquid hydrogen, however, and the really long trip begun.

The Moon revolves in an orbit around the sun along with the Earth. Its speed is such that the attraction of the sun is just balanced. If the ship adds its speed to that of the Moon it will move too fast for the sun to hold it in this orbit, therefore it will drift outward in the solar system, away from the sun. Farther out

is the orbit of Mars, and that planet too moves with just the speed which balances the attraction of the sun. Since there, farther out, the sun's attraction is less powerful, Mars can move more slowly, and does. While the ship is coasting outward, the sun, of course, is steadily pulling at it from inward, and it is this pull which decreases the ship's surplus speed, so that when it gets to Mars the speeds of ship and planet will very nearly match.

Most of the trip from the Moon to Mars is again performed on momentum, just like the trip from Earth to the Moon. And, strangely enough, the trip from Moon to Mars does not require much more "throw-away mass" (hydrogen) than the trip from Earth to Moon. But it is going to take much longer. Just how long it takes will depend partly on the relative position of the planets, but mainly on the amount of fuel available. The maximum duration is 258 days for the trip; with some extra fuel expenditure this could be cut down to some 80 days. Most of the extra expenditure would be made when the ship comes close to the planet. The ship may have too much surplus speed when it gets there. Such speed would have to be reduced by





Chester Bonaparte

rocket action, or the ship would overshoot its mark.

We know that there is water on Mars. The blinding white polar caps of that planet, as seen in the telescope, prove it. But the fact that the polar caps melt completely during the Martian summer also proves that there is not very much water—a customary estimate assigning an average thickness of $2\frac{1}{2}$ inches. Still, what

Tail first, stern rockets braking her forward momentum, the ship drops to the pitted face of the Moon. Will the Earthmen find water there?

is very little water for a planet is a great deal for a space ship, even for thousands of them, so the problem of getting fuel for the return to Earth is easy, as far as the planet Mars is concerned.



Ice has been found and the critical supply of liquid hydrogen replenished. The ship stands nose up, all ready for the long dart to Mars.

During the long drift outward the pilot of the space ship can establish his position well enough by means of astronomical observations, but when he approaches the planet closely these will not be precise enough. With the in-

struments which a space ship could carry, an error amounting to a few dozen miles could be expected. As long as the planet is a million miles away, such an error does not matter. Later it might become disastrous. But experiment has proved what was theoretically certain from the outset—that a radar set is a means of measuring distance in empty space as it is on Earth.

We know what an exploring party will

mainly find on Mars—sand. But we have no idea what else such a party would find. There are dark areas which once were taken to be seas. Now it seems much more likely that they are not seas, but either just darker areas, areas of ground darker than light-colored desert sand, or areas of vegetation. It seems quite certain that some of them are areas of vegetation. We still don't know what the famous "canals" are. What we see might also be vegetation. There is no way of telling from this distance whether rows of stagnant pools are in the center of these possible lines of vegetation. Or what else. They might, they just conceivably might, be actual old canals, long broken down and useless. It will take a space ship to find out.

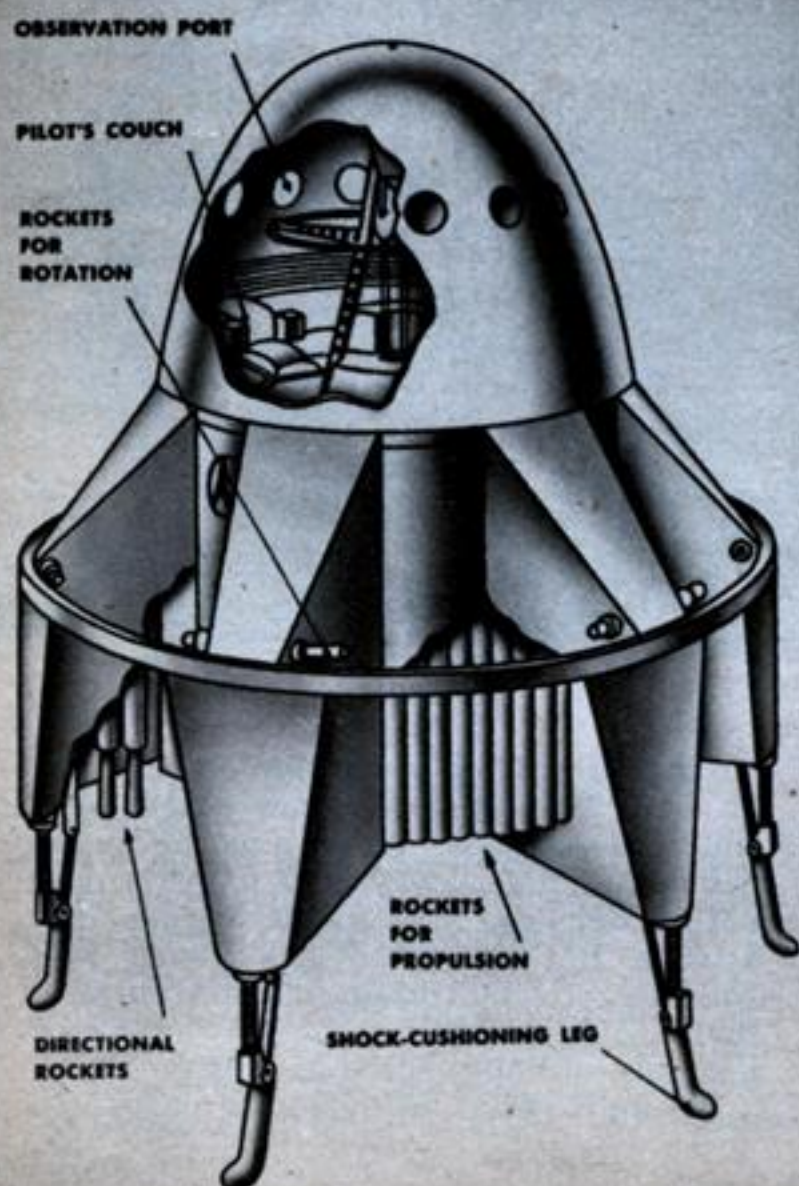
The explorers will have plenty of time both to find out and to recharge their liquid hydrogen tanks. The reason is, the planets move. And that they move with different speeds. If the explorers decided to return to Earth after a week's stay, they could easily return to Earth's orbit—but the Earth itself would be a very, very, very long way from the point of its orbit which they would reach. To set out

on the return trip at once would require either an ultra-powerful ship or a period of patient waiting. And since the first ship is likely to be under-powered rather than over-powered, a waiting period is indicated. In the most unfortunate case that waiting period would be 455 days, about a year and three months; but if there is some power reserve available, that waiting period can be cut down to only a few months, about the time which would be needed for purposes of general exploration. The ship, while waiting, could easily make exploratory trips to the two small moons of Mars, Phobos and Deimos, or to distant points on Mars itself, since the hydrogen these short trips would use up could always be restored. It is only the long drift inward through the solar system, the long drift home, which requires waiting and timing and hoarding of fuel supplies.

The trip back will in one way be the same maneuver which got the ship to Mars, but in others the opposite of that maneuver. Mars, you remember, moves in its orbit with just the velocity needed to counterbalance the sun's attraction. If it moved more slowly than it does, its

speed would be insufficient to counterbalance the sun's attraction and it would begin to spiral toward the sun. When the space ship takes off from Mars it deliberately effects just that. The synergy curve will be pointed in such a way that the ship falls behind the planet and is, seen from the sun, slower than the planet.

This being the case, the sun's attraction wins out over the speed of the ship and draws it inward, in a long ellipse, and as the ship is drawn inward it moves faster and faster. Since we have talked about a surplus speed for the first maneuver, we might call this a deficit speed. If the deficit speed is measured just right in the beginning, the ship will drift inward in the solar system until it reaches the orbit of the faster-moving Earth, having picked up, while drift-



Rocket head, another type. Not shown are the banks of rockets discarded as used up in flight.

With slight changes this pilot's stratosphere suit can be used on the Moon—or in space between the planets—where there is no atmosphere.

ing, enough speed (much as a stone rolling downhill picks up speed) to match that of the Earth. And if the timing is right, the Earth will be in that spot, or very close to it.

This sounds fine, but the trip is not yet over. The Earth has its gravitational field, too, and when the ship gets close, Earth wants to draw it down. But the Earth also has an atmosphere, which here is fortunate, for it is possible, by careful maneuvering, to utilize the atmosphere as a braking medium.

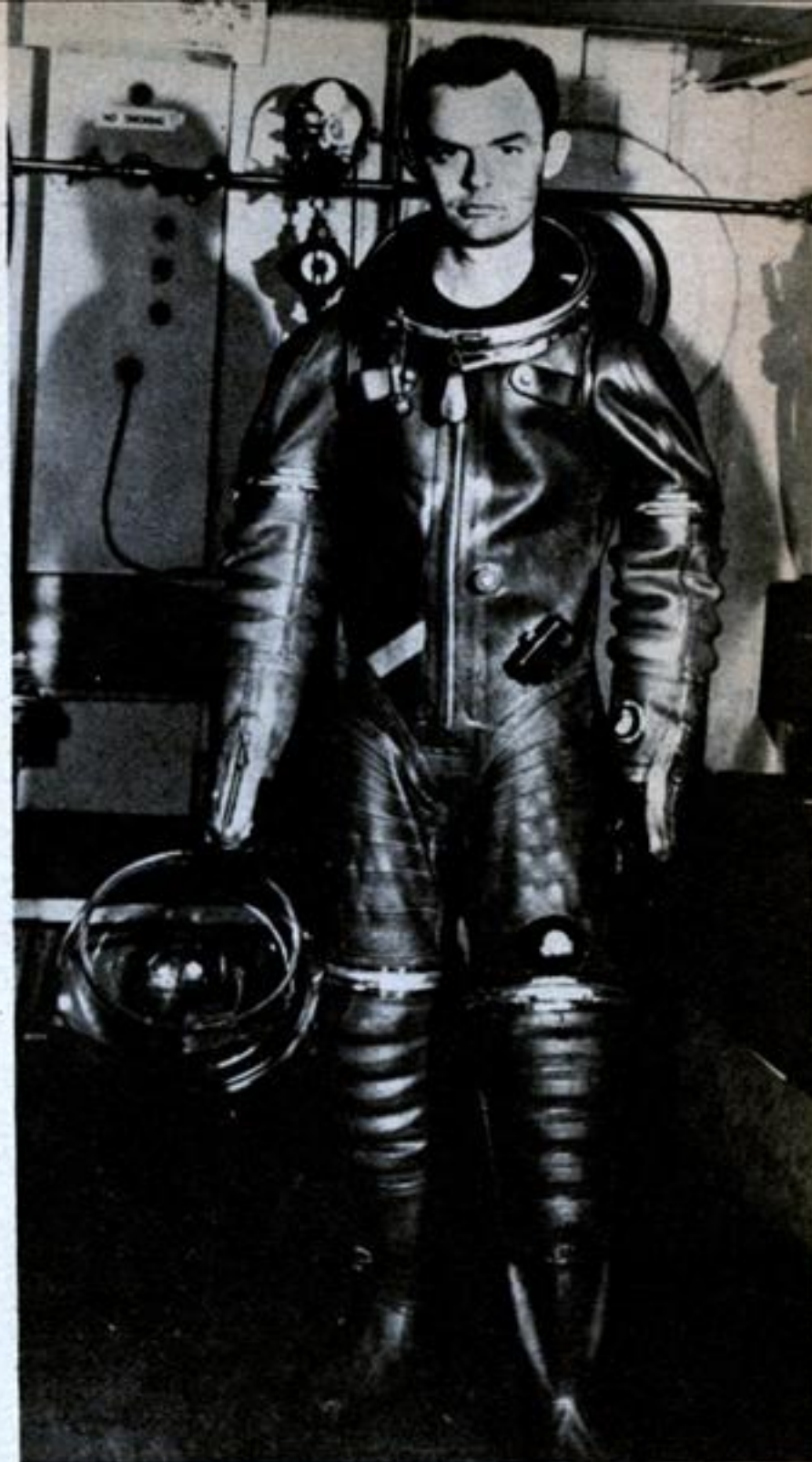
If the ship were allowed to plunge straight into the atmosphere it would simply burn up, like a meteorite. But if it is made to just graze the outer layers, its speed will be reduced somewhat, without the ship's being heated to a dangerous extent. Swinging out into space again it will cool off, radiating the heat away, and be ready for the next grazing. This will be repeated four or five times. Each time the speed will be reduced further, so that, in the end, the ship will be ready for landing. (By the time the first ship returns from Mars, this maneuver will be well known and well tested by pilots who have returned from trips around the Moon.)

Once definitely inside the atmosphere, additional parachute-like "air-brakes" can be used. The first few may burn up; but each one, even if it is destroyed, will in the course of its use reduce the ship's speed some more, helping it finally to approach the surface with reasonably slow speed. The final landing may need rocket help once more—but that will be rocket help without the collaboration of the atomic pile. It will be hydrogen gas burned with oxygen in the old-fashioned manner, so that the landing area will not be drenched with radioactivity.

The exploration of space will be the next great chapter in the history of humanity, and it may be that this exploration will help to avert future wars. Because when a man meets another man on the Moon, or on Mars, or on Venus, that man will no longer be a Frenchman, or a Russian, or a Chinese, but another man from Earth.

The exploration of space will not begin tomorrow or the day after, but it is so close that most of the people now alive will see its beginning. In the laboratories scientists are hard at work on problems that already begin to yield. The race to the planets is on.

July, 1947



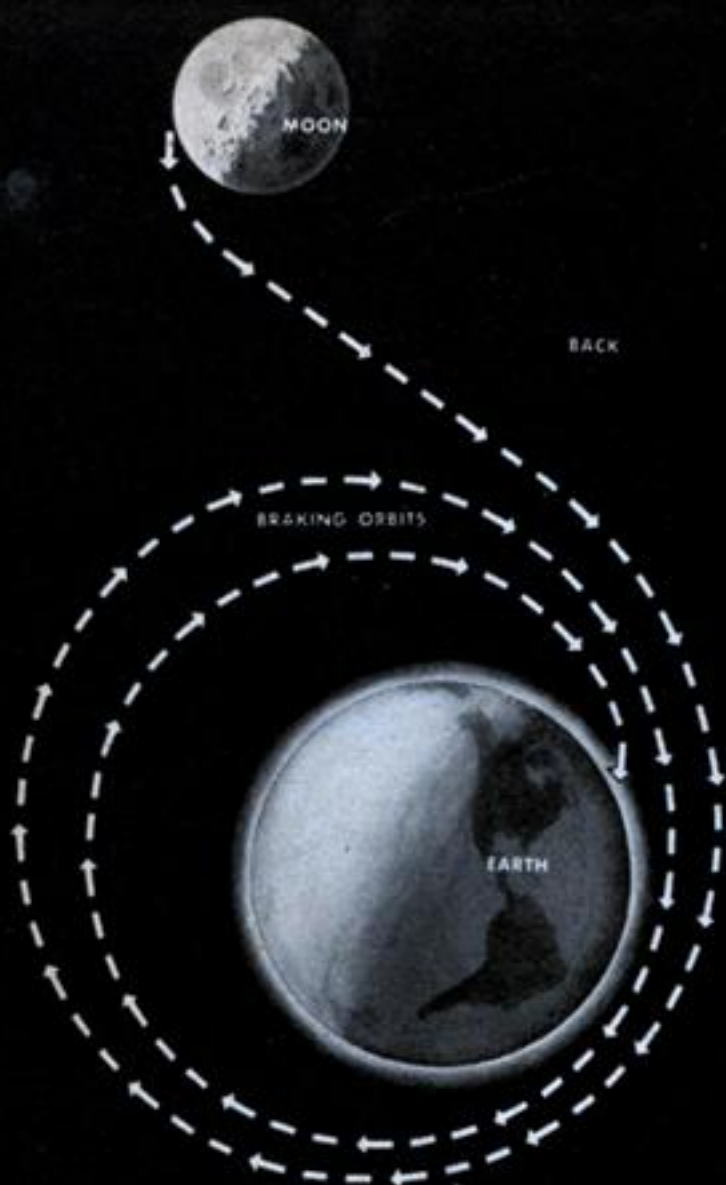
britain's challenge

BY ALFRED ERIS

The British Interplanetary Society is working at top speed to put a Made-in-Britain space ship on the Moon—first. On the following pages MI presents a summary of their program, obtained by Alfred Eris in an exclusive interview with officials of the Society in London. Here is a serious challenge to American rocket-men!

BBRITISH scientists are working at top speed on plans to conquer space and already have outlined a five-stage program to culminate in the voyage of a space ship to the Moon.

The British Interplanetary Society has subdivided itself into research groups, the better to tackle the many different problems of space travel, and at the same



Returning, the space ship will make a series of braking orbits—dipping carefully into Earth's atmosphere to lose speed without burning up.

two units. All three parts of the station will be aided by small jet-propulsion units to swing on their own axes at the distance considered most convenient, 150,000 miles from Earth. Turbines on the space station will be spun by nitrogen. There will be no loss of this gas as the units will be working in a closed cycle.

The space station is expected to be built piecemeal by parts brought up from the Earth. Centrifugal force will maintain it in its orbit between the Earth and other planets.

British scientists consider the space station of paramount importance for, as always, the prime problem is fuel. No other factor is expected to be half so troublesome. If atomic energy can be utilized, their worries will be just about over. Failing that, they look at current research statistics and shudder.

For figures now available indicate that a round trip to the Moon, including a landing there, will require 229 tons of fuel for each ton of payload. If no landing is made, the amount will be cut by 60

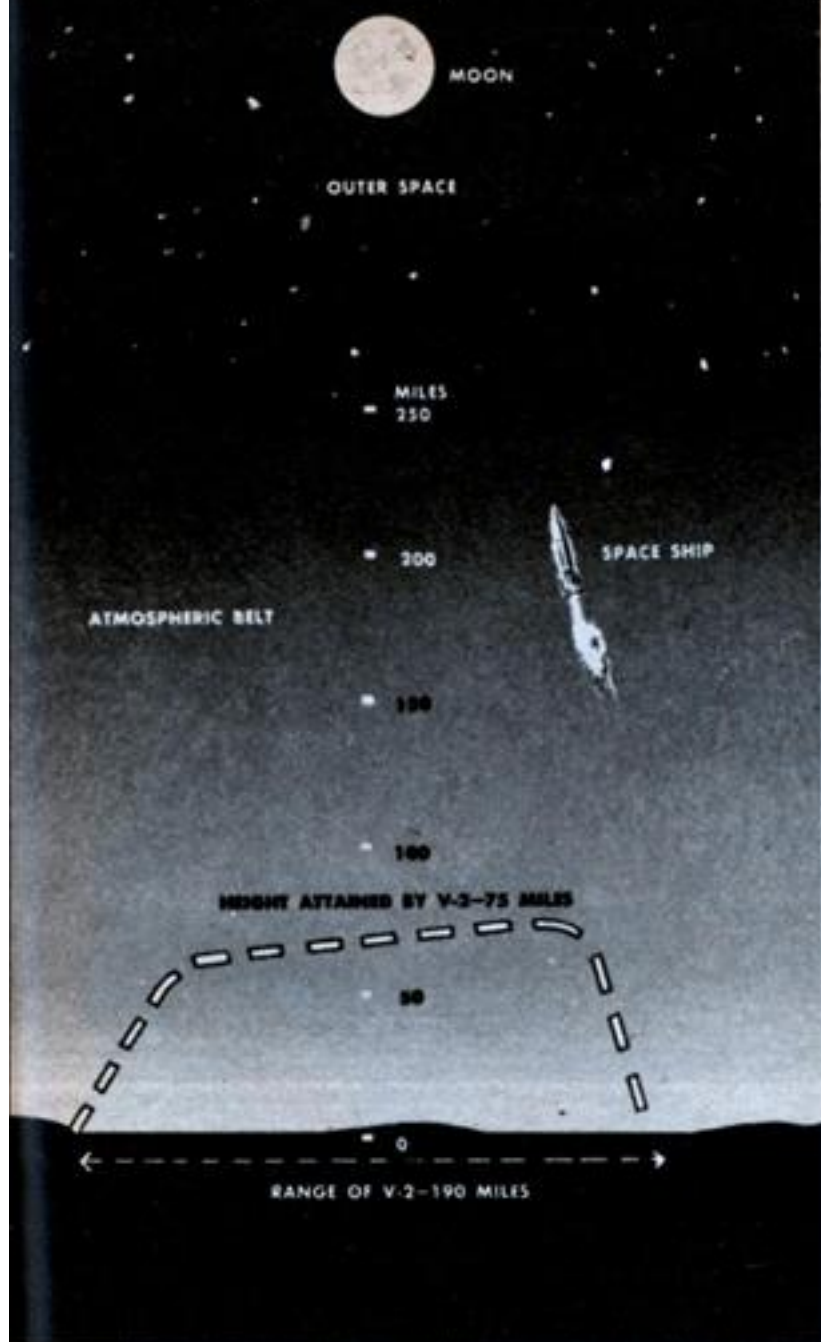
which is a rotatable air-lock, which will spin in the opposite direction from that of the space station itself, to enable passengers to step from the ship into the station. Imagine the living quarters in the shape of a ring around the cylindrical powerhouse, about halfway up, and from the living quarters, attached by means of spokes, an annular ring, parabolic in shape. The other end of the powerhouse culminates in steam coils, surrounded by a wide annular ring, smaller than the first but also acting as a parabolic reflector to trap the rays of the sun.

The intense heat generated thereby can be counterbalanced by "cold coils" on the back of the annular rings, which will be in perpetual shadow and intensely cold.

The auxiliary powerhouse consists of a smaller power station with a parabolic mirror. The observatory has neither reflectors or rings. Conditioned air and electrical power are supplied by cables stretching like tentacles from the first

The Moon landing will not require a series of braking orbits, for our satellite lacks an atmosphere and has far less gravitational attraction.





The most critical part of the Moon hop will occur during the take-off and transit through the frictional resistance of Earth's 250-mile atmosphere.

tons. These figures are based on the best propellant available today, a combination of liquid oxygen and liquid hydrogen, which will yield a speed of a little over three miles per second. But, obviously, the consumption of fuel is based on the chemical energy of the fuel, and if a small atomic-energy unit can be harnessed the boys will have no cause for weeping.

Radio communication between Earth and the space station will be simple. A beam of only 50-watts power is considered ample, as there is no attenuation with distance in a beamed signal, and the space station will obviously be in the direct line of sight.

The British space-travel enthusiasts were delighted to hear, recently, of the assertion by one of the foremost German rocket men, Von Braun, that the Germans were working on rocket space ships and expected them to be in use in 10 to 15 years. This period they hope to cut down considerably by intensive work carried on

right now by research groups throughout England.

For the sake of efficiency, the Society has organized research sections under the following classifications: Orbits (involving their best talents for mathematical calculations and computations), Fuel, Electronics (including Instruments), Structures, Motors, and Nozzles.

Opening their great scheme of interplanetary exploration will be a flight to the Moon. Since the Moon's low gravitational influence (about one-sixth that of the Earth), will require much less power for the space ship to free itself of its field, the Moon suggests itself as the ideal jumping-off spot for voyages to Mars and Venus, next on the itinerary.

The voyage of 240,000 miles to the Moon is expected to be nowhere near as formidable as it sounds, once the fuel problem is solved more satisfactorily. Driven by chemical reaction units, the space ship could do it in 48 hours. Venus, which is 26,000,000 miles at its closest approach to the Earth, is considered 48 days' travel, and 90 days will be needed for Mars, 35,000,000 miles away.

Atomic energy, harnessed and adapted specifically to rocket propulsion, promises the super-concentration of power which will bring travel to the planets down to a matter of hours and not days. The space ship will make ample use of radar in altimeters and meteor detectors. Although hitting a meteor is a distinct possibility, the mathematical chances are so minute that the scientists refuse to worry about them.

To deal with the effect on any space ship of the intense heat on one side and the extreme cold on the other, the British machine will rotate in its flight at the rate of three revolutions per second.

Communication between the space ship and Earth will be by means of ultra-short-waves beamed directly, as between the space station and the Earth.

The approved design for a space ship provides for a cylindrical rocket with a control chamber in its nose for a crew of three astronauts, or space travelers. The ship will be powered by main and auxiliary jets, the whole propulsion system having a honeycomb design and the firing of the rockets in series being under the control of the crew, who will regulate the rate of ascent so as not to accelerate at a speed which might be injurious to the human body. As it spends its rocket tubes, the space ship will jettison them.

When nearing the Moon, the auxiliary jets will very gradually be employed to turn the ship over, so that the landing is made stern first, in position for the takeoff.

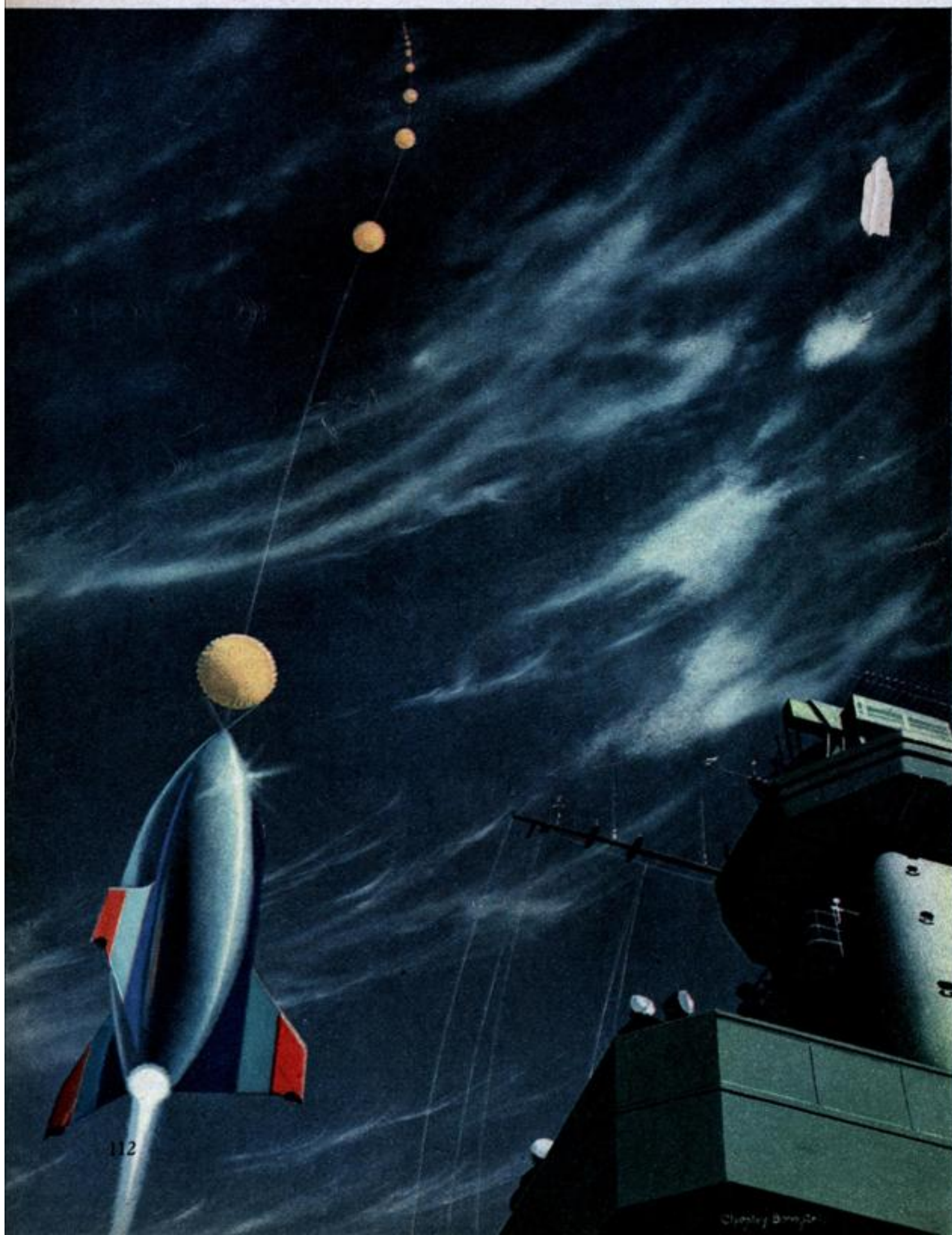
Landing will be made by the power of the main jets. On their return to Earth, the astronauts will detach the nose part of the rocket with its equipment, and it—and themselves—will be landed by parachute.

The astronauts will, of course, wear conditioned suits specially built to withstand lack of atmosphere and extreme cold. It is thought that any leading manufacturer

of high-altitude equipment in Britain could take the specifications and make their space suits to order.

The question of the effect of almost unthinkable speeds [Continued on page 162]

Final slow-down to a landing on Earth, after the series of braking orbits, will be effected by means of a long string of parachute-like "air brakes."



phere fame, makes his fateful experiment.

But will his invention, upon which he has worked for years, rise to the surface? The professor himself does not know. The answer will be flashed to the world from the west coast of Africa on a February morning when the professor attempts to descend four miles into the ocean, far deeper than the present record of 3,028 feet held by Professor William Beebe.

The steel sphere in which Piccard will make his perilous journey into the unknown weighs ten tons, is nearly seven feet in diameter and has walls three and one-half inches thick. Nevertheless, without ballast, it is lighter than sea water, and therein lies the professor's hopes.

Without the lighter-than-water twist,

the bathyvessel would plummet into the sea and be lost forever. For there will be no cable, such as was used by Beebe, to haul it back to the surface. A cable would permit Piccard's sphere to dangle no deeper than Beebe went . . . if he went further the weight of the cable would almost certainly cause it to snap.

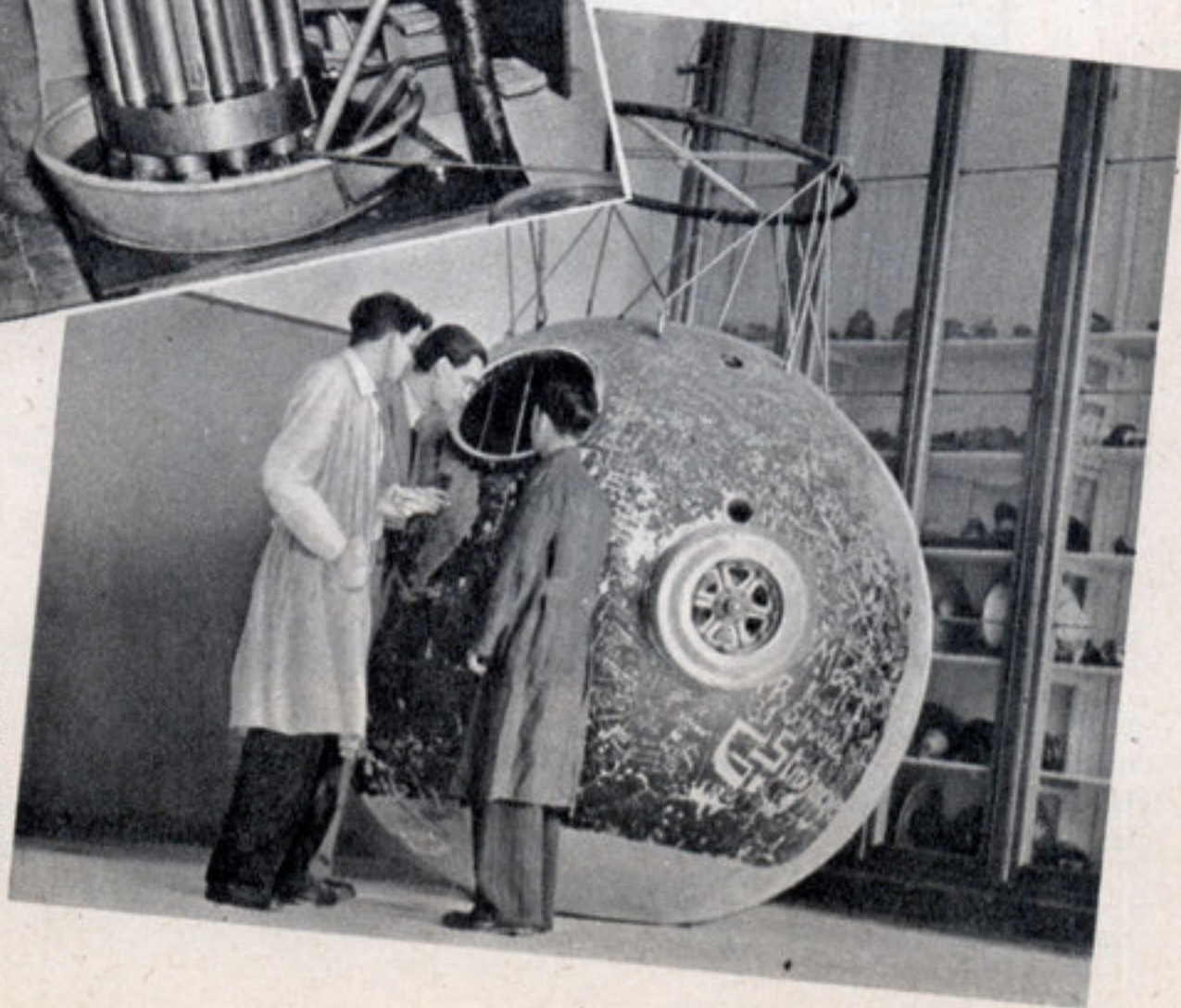
Piccard hopes to rise again through applying the balloon principle to his queer submarine. To the sphere Piccard has attached a boat-shaped float filled with 494 cubic feet of a light, buoyant oil. This takes the place of the hydrogen gas bag on a balloon. Below it, held tightly by electro-magnets, are large chunks of iron ballast. If a speedy ascent is demanded, these large pieces of iron can be released, but the professor has arranged for a slow, controlled method of rising. In a large copper funnel he has placed hundreds of pounds of iron filings. When current to the electro-magnet is cut, the filings flow out at the rate of 60 pounds a minute.

There are two plastic port-holes, six inches thick, on each

Left: In this tester, Piccard and Cosyns give their model 3,000 lbs. pressure. It hasn't broken—yet.



After Piccard went up five miles in his balloon—cabin, right—he promised his wife he'd never go stratospher-ing again. Stuck with that pledge, he'll go four miles underwater.



A FAWCETT PUBLICATION

NOVEMBER

NSC

10¢ MECHANIX ILLUSTRATED

(Reg. U.S. Pat. Off.)

4 MAGAZINES
IN ONE

THE LIGHTNING P-38

458 m.p.h. and props turn
in opposite directions



**"OUR SECRET NAVY"—America's
Ghost Fleet Now Haunts the Seas • See Page 35**

MECHANIX ILLUSTRATED

A FAWCETT MAGAZINE

DECEMBER
15^C

JET-POWERED SPORT PLANE
Is In the Works . . . Page 42

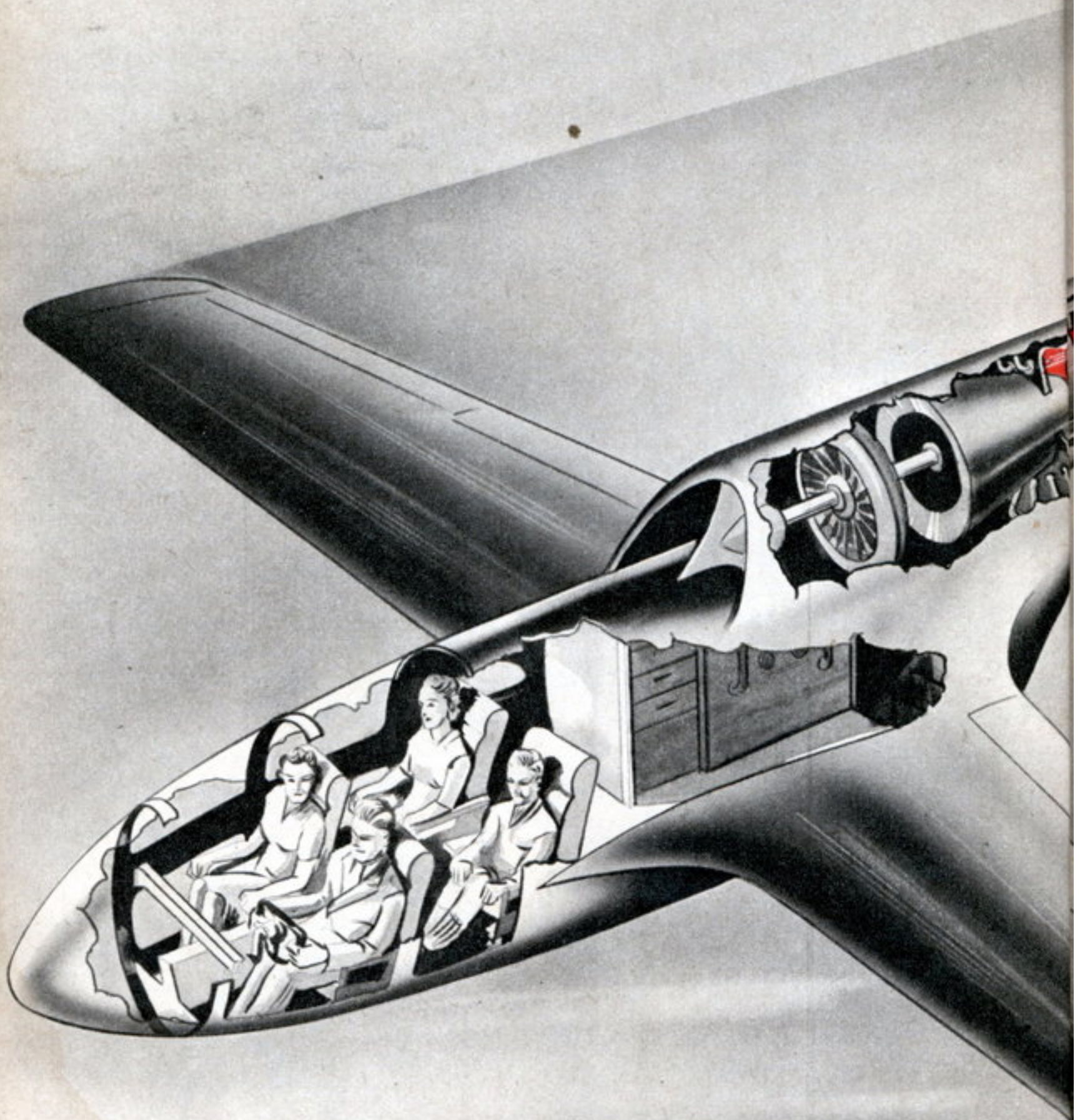
In Full Color:

**FLUORESCENCE
WILL LIGHT
TOMORROW'S
CITIES**

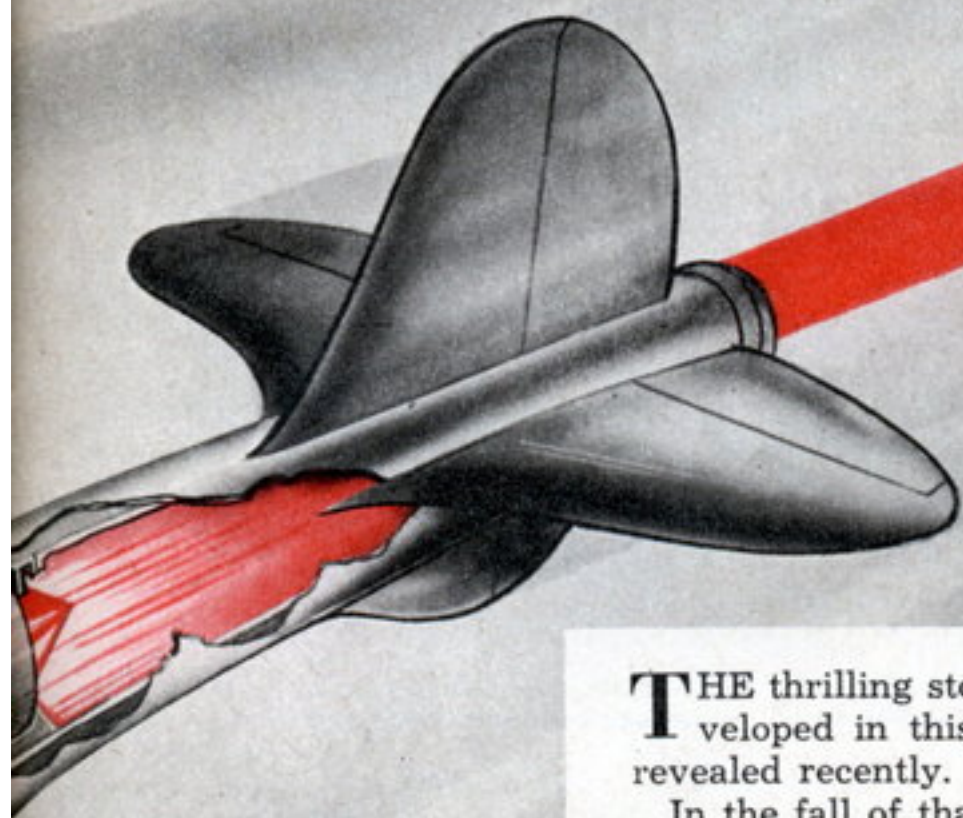
By Samuel G. Hibben
Page 67

THE JET PLANES

ARE HERE!



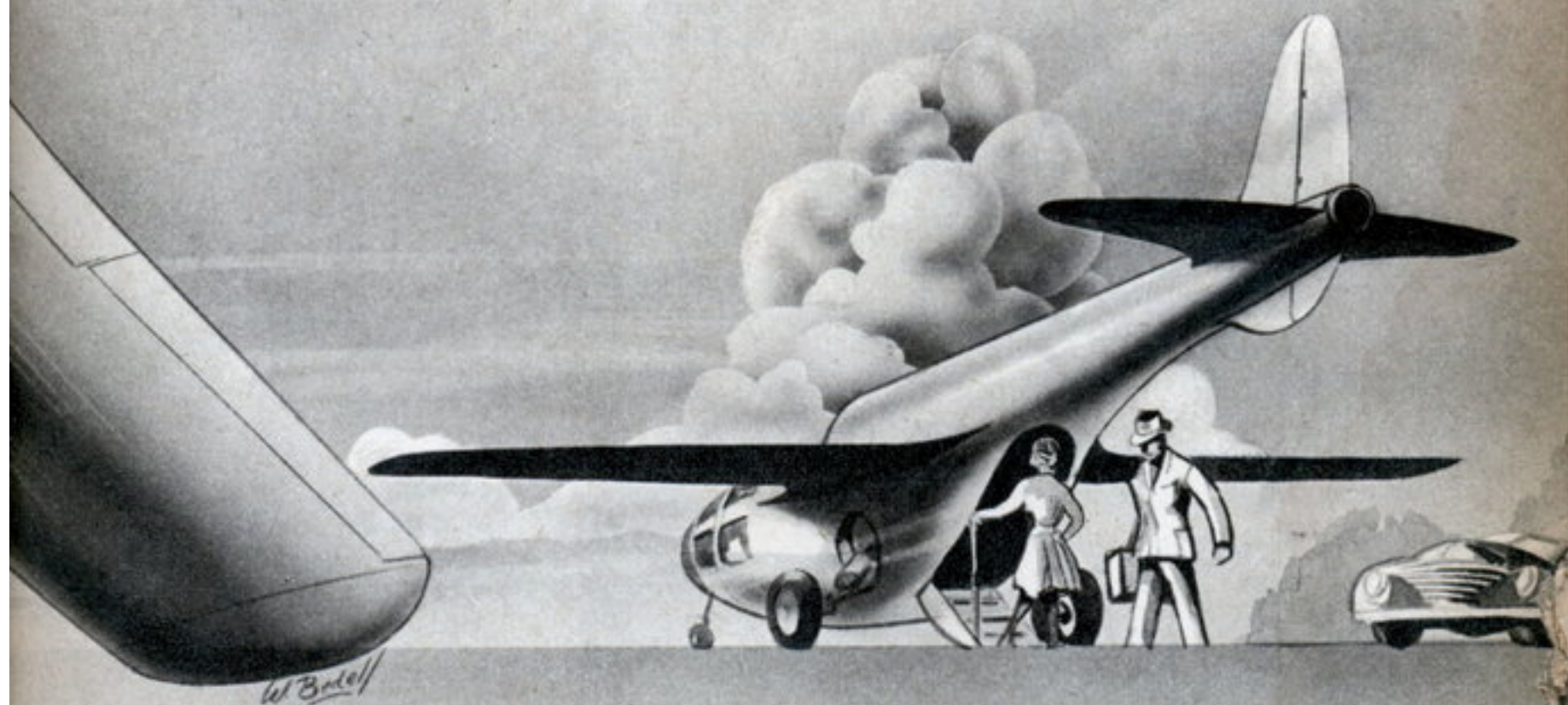
THIS JET-PROPELLED FAMILY PLANE, adapted for postwar use from military models, will have four times the speed of the family car, room for four and baggage, a pressurized cabin, and plastic windows to shut out harmful sunrays. Some models may dispense with control surfaces by use of directional exhaust.

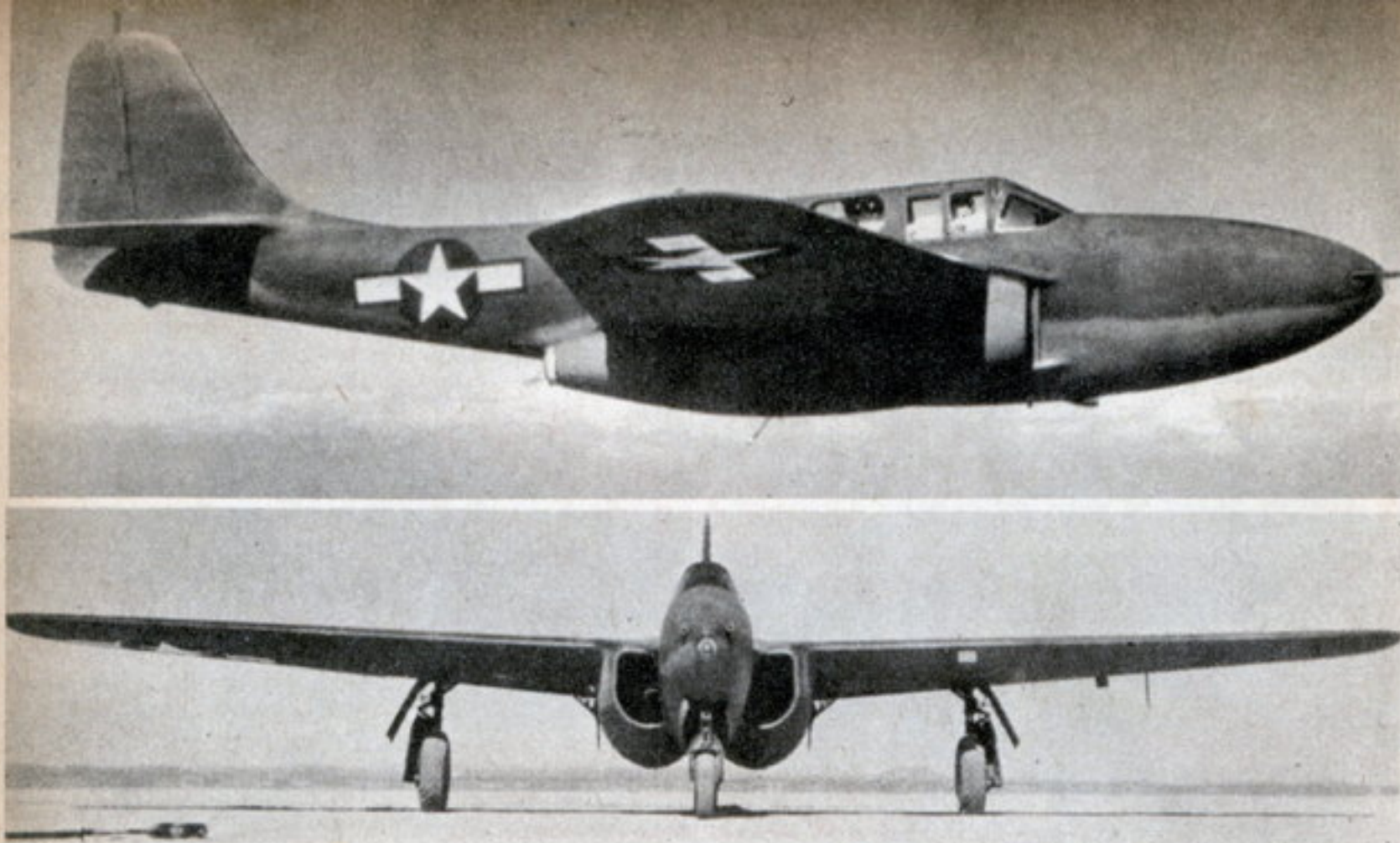


THE thrilling story of how the jet-propelled plane was developed in this country in almost complete secrecy was revealed recently. The beginnings go back to 1941.

In the fall of that year, the employees of the Statler Hotel in Boston were puzzled by the behavior of a mysterious English guest named Whitely. He ate his meals in his room, had a private telephone installed which did not go through the hotel switchboard, and asked that all his errands be handled by one bellboy. After a week, he left the hotel.

The Statler employees will learn now for the first time that the man's real name is Frank Whittle, that he is a flight commander in the RAF, and that he is the inventor of the jet-propelled plane. His mission, during his three-and-a-half





First pictures of the first American jet-propelled plane, the P-59A Airacomet built by Bell. Side view (above) shows one of the jet nacelles. Head-on view (below) shows intake vents and guns.

months' visit to this country, was to assist American engineers in the design and production of the first jet plane built in the United States. Less than half a dozen people knew his real identity or his purpose in being here.

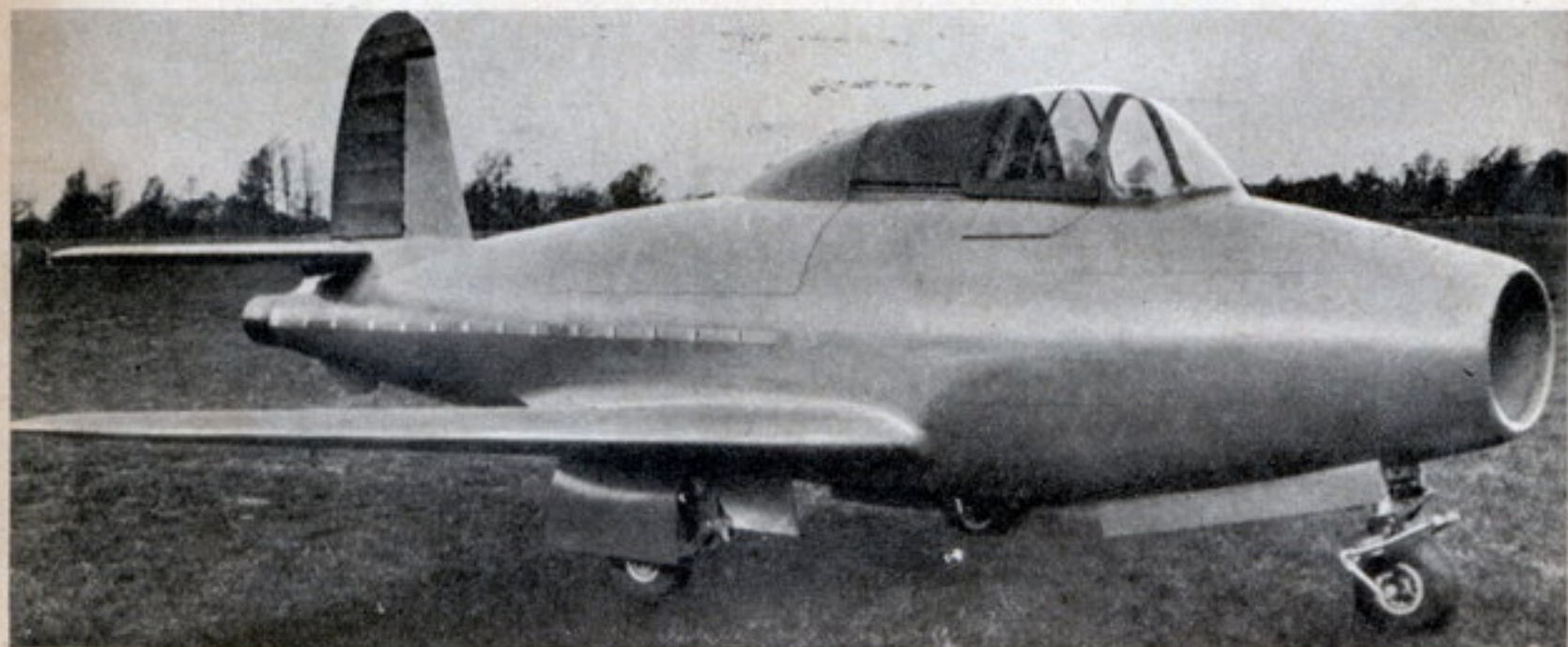
Whittle moved from the Statler to the home of R. G. Standerwick, supercharger engineer connected with General Electric, who was assigned to the job of working on the jet plane. Even Mrs. Standerwick did not learn until this year who her visitor was.

Plans and parts of the British jet plane,

and three English workers, were brought to this country in the same secrecy, and installed in an old building which was kept under heavy and constant guard. Only about a hundred people out of G.E.'s 190,000 employees knew what went on there.

The result of all these precautions was that hundreds of jet planes developed and produced by combined Anglo-American efforts, successfully took part in the repulse of the German robot bombs over London this summer. These planes were British Gloucesters. The first American jet plane is the

The British jet plane, Gloucester, played an important part in turning back the robot attack on London.



P-59A Airacomet, which has not yet seen combat, but which has proved itself in test flights to be very fast and to have a high ceiling.

The Gloucester was said to be superior to a German version that has been engaged by the Allies' fighters on several occasions. The pilots report that the German fighter had poor maneuverability but a high speed and rate of climb, and Supreme Headquarters warns that more extensive and effective use of the German type jet plane is to be expected. Jet propulsion is more efficient than internal combustion only when used at speeds approaching that of sound. Flying at 100 miles per hour for 400 miles, a jet engine will use 70 gallons of fuel to a gasoline engine's 16 gallons; but at 600 miles per hour over the same distance, the jet engine will burn 770 gallons, the gas engine, 850.

The Navy now uses jet units to reduce takeoff runs 33 to 60 per cent. They are specially useful on carriers and for heavy-laden bombers, resemble bombs fixed to fuselage.



JET ASSISTS TAKE-OFFS— From Land - - -



From Water - - -



From Carrier



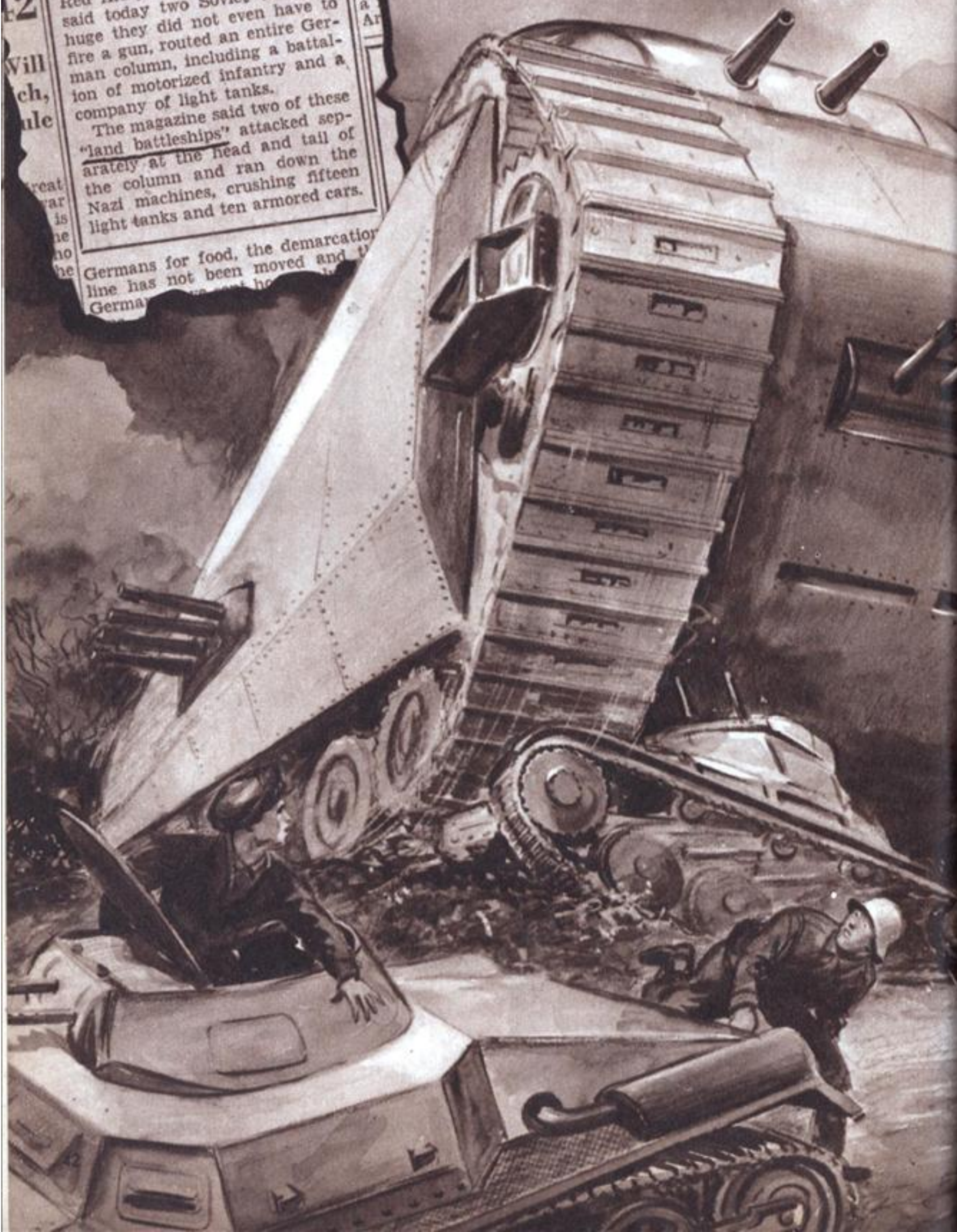
Soviet Tanks So Huge They Flatten Enemy's

MOSCOW, Aug. 5 (P).—The Red Army magazine "Red Star" said today two Soviet tanks, so huge they did not even have to fire a gun, routed an entire German column, including a battalion of motorized infantry and a company of light tanks.

The magazine said two of these "land battleships" attacked separately at the head and tail of the column and ran down the Nazi machines, crushing fifteen light tanks and ten armored cars.

Germans for food, the demarcation line has not been moved and the German army sent home.

Now it's LAND

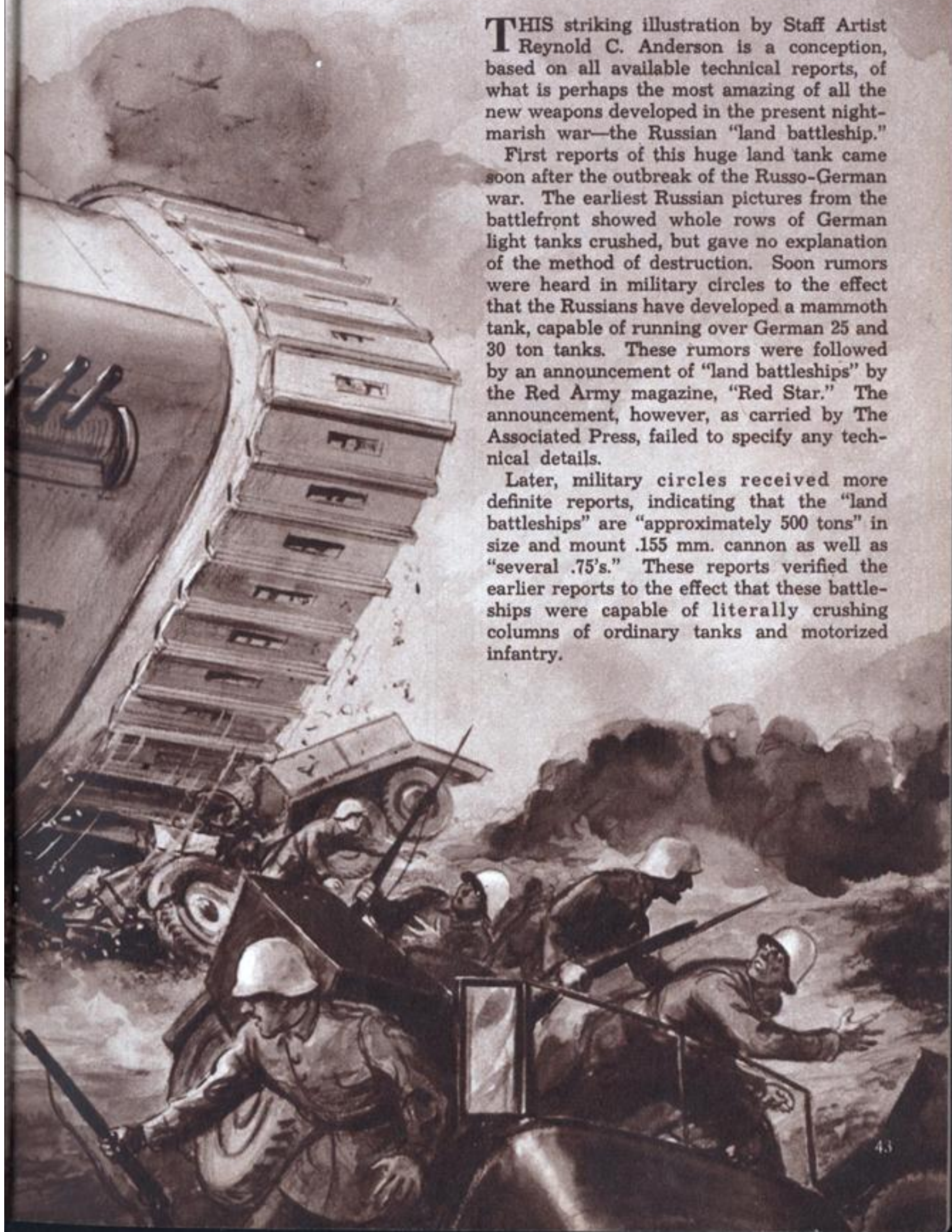


BATTLESHIPS!

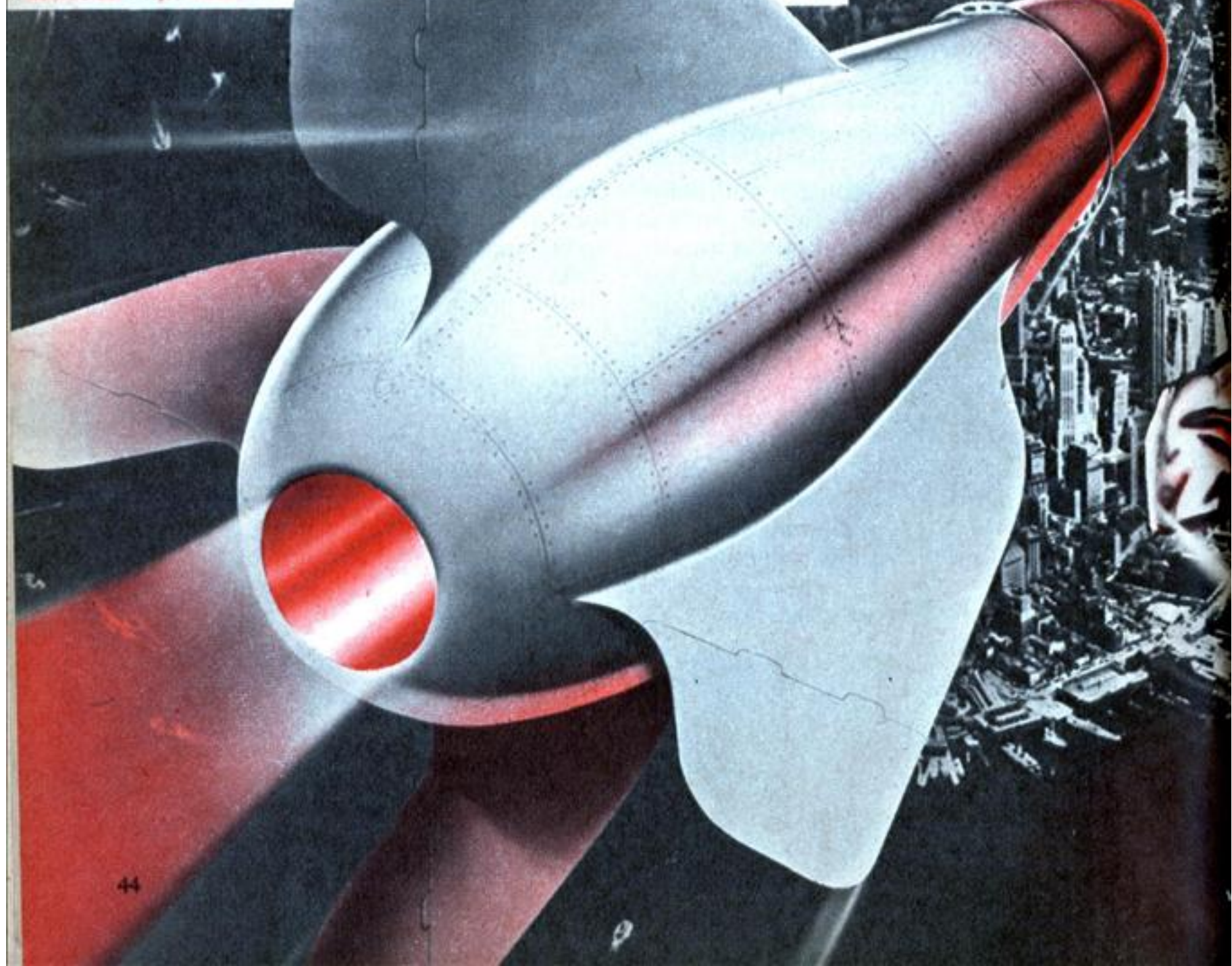
THIS striking illustration by Staff Artist Reynold C. Anderson is a conception, based on all available technical reports, of what is perhaps the most amazing of all the new weapons developed in the present nightmarish war—the Russian “land battleship.”

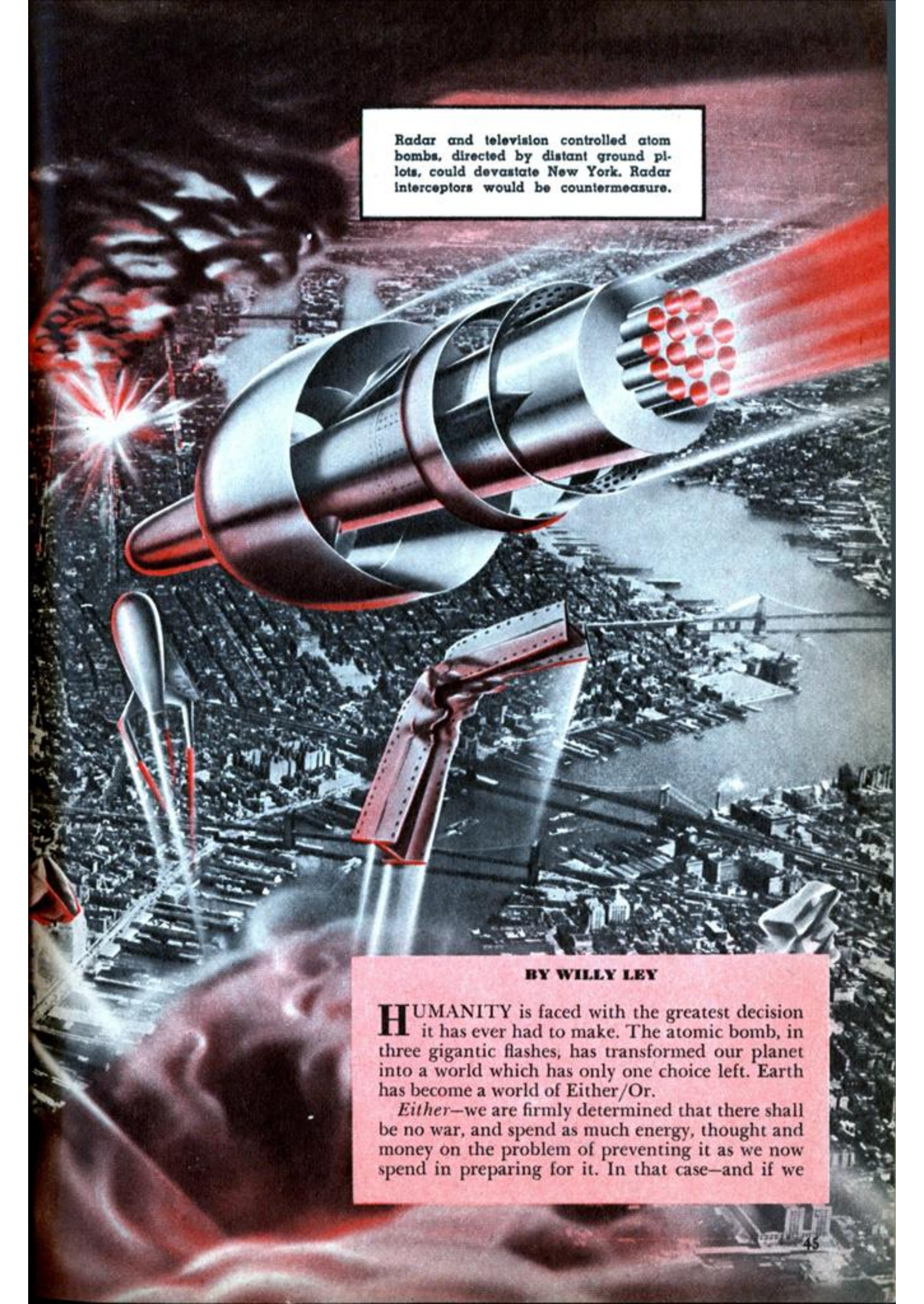
First reports of this huge land tank came soon after the outbreak of the Russo-German war. The earliest Russian pictures from the battlefield showed whole rows of German light tanks crushed, but gave no explanation of the method of destruction. Soon rumors were heard in military circles to the effect that the Russians have developed a mammoth tank, capable of running over German 25 and 30 ton tanks. These rumors were followed by an announcement of “land battleships” by the Red Army magazine, “Red Star.” The announcement, however, as carried by The Associated Press, failed to specify any technical details.

Later, military circles received more definite reports, indicating that the “land battleships” are “approximately 500 tons” in size and mount .155 mm. cannon as well as “several .75’s.” These reports verified the earlier reports to the effect that these battleships were capable of literally crushing columns of ordinary tanks and motorized infantry.



PEACE— OR ELSE!



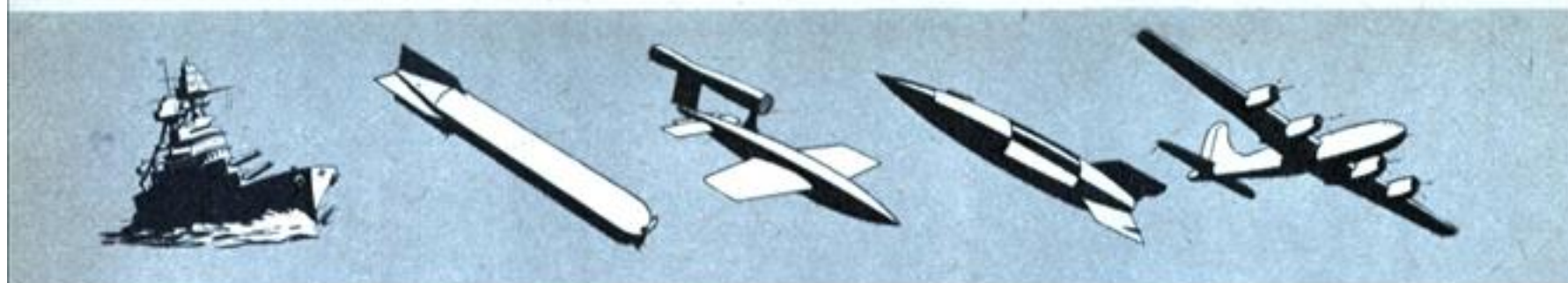


Radar and television controlled atom bombs, directed by distant ground pilots, could devastate New York. Radar interceptors would be countermeasure.

BY WILLY LEY

HUMANITY is faced with the greatest decision it has ever had to make. The atomic bomb, in three gigantic flashes, has transformed our planet into a world which has only one choice left. Earth has become a world of Either/Or.

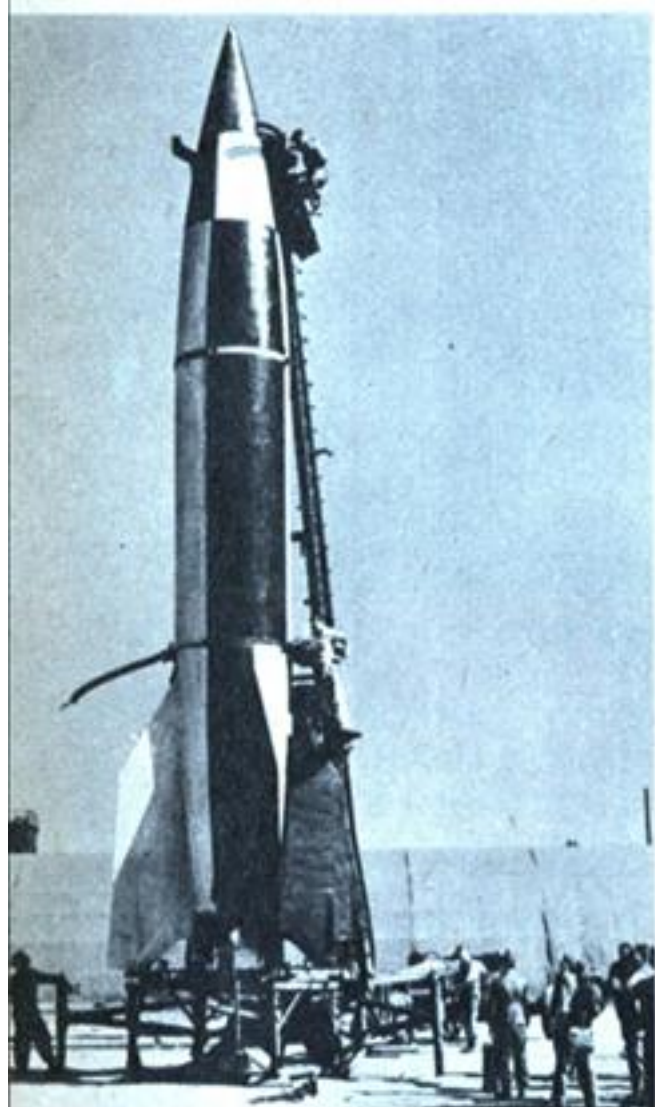
Either—we are firmly determined that there shall be no war, and spend as much energy, thought and money on the problem of preventing it as we now spend in preparing for it. In that case—and if we



succeed—the future promises a period of incredible achievements, of unlimited progress, of infinite riches of knowledge and material riches, of immediate preliminaries to humanity's spread through the solar system as a first step to a spread through the galaxy.

Or—we blunder into irretrievable errors, such as trying to outlaw atomic energy, or believing that size and distance will save us, or thinking that there can be war only between other nations.

Siege howitzer, mortar or coast guns have too short a range.



Bombs of V-1 and V-2 types can be atomic. Bombers like B-29 can carry atomic charge; battleships and torpedoes—maybe, if range is greatly increased.

If we choose the latter course, we will almost inevitably become involved in another war—an atomic war. . . .

Atomic war will come without warning and without declaration, with a fury so monstrous that the mind cannot conceive it. The first authentic publication on the subject, the report written for the War Department by Professor H. D. Smyth,

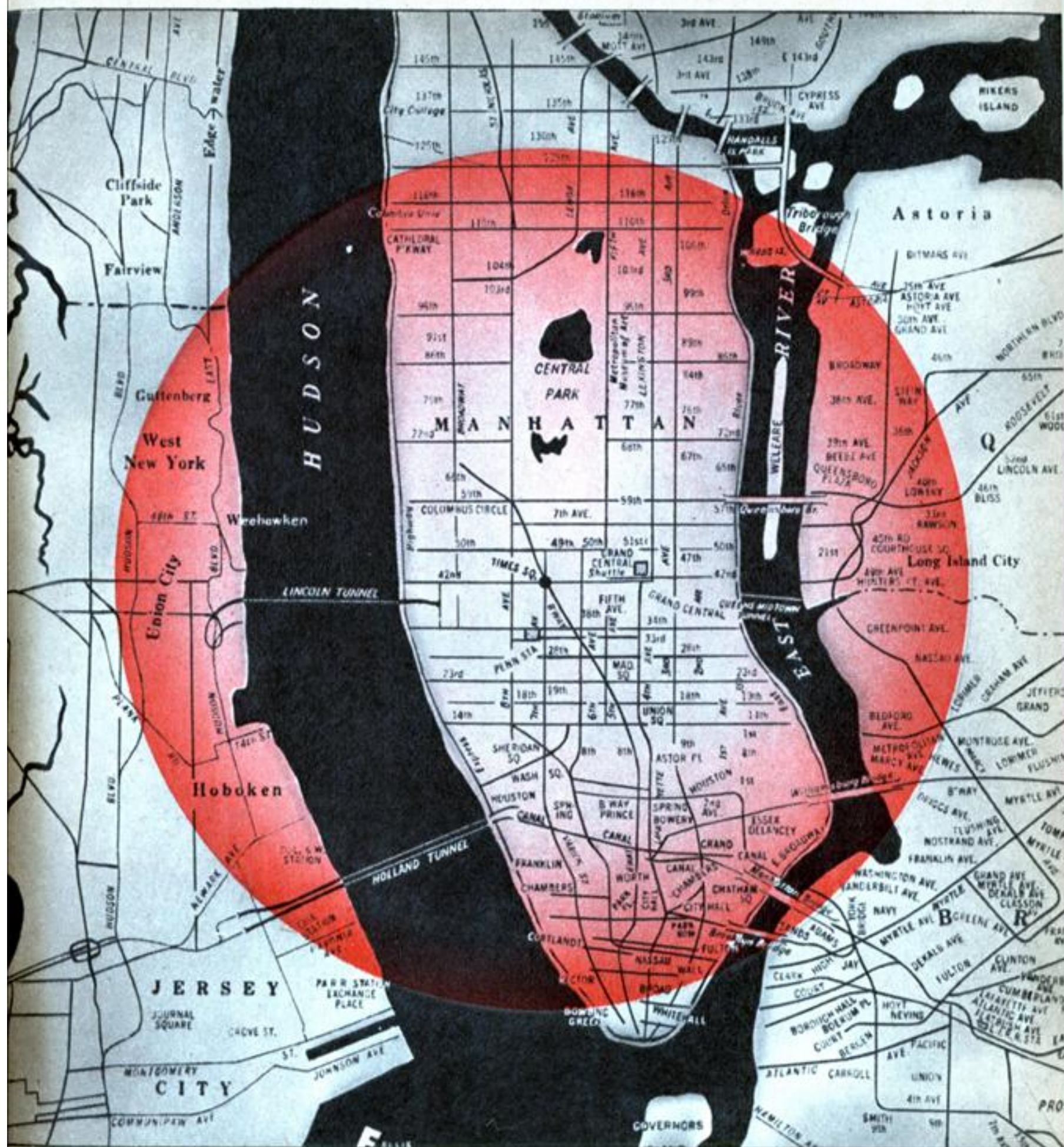
(Atomic Energy for Military Purposes), has already pointed out that the atomic bomb is especially suited to sudden, unannounced attack—blitzkrieg to make the Nazis' version of it pale into insignificance. "A country's major cities might be destroyed overnight by an ostensibly friendly power," as Professor Smyth puts it. Overnight destruction of America's major cities means the death of eighty million people in twelve hours—57% of the population! That is, tragically for us, not a nightmare, but a very definite possibility.

The possibility can in no way be done away with by preventing potential aggressors from obtaining the "secret." Several nations stood on the threshold of atomic energy when the war started: we barely won the race. *Within five years*, every nation will be able to construct atomic bombs, even though they will not be able to keep that fact secret. The prevention of war, therefore, is not a scientific problem—it is a political problem.

Of course, destruction would

Photos show actual firing of captured V-2 by British research scientists.

Mechanix Illustrated



Red circle shows area of vaporization which would be caused by 1-ton atomic bomb dropped in Times Square. All surface structures within radius of 8 miles (double radius shown) would be demolished. If bomb hit the ground, earthquake would result, causing destruction of any underground installations.

be mutual. The Intelligence Service would know that war was brewing, and the military could get ready to hit back. The result would be destruction of all the centers of population and manufacture of *all* the belligerents, with nothing left after two days of war but small and unimportant villages and only about

one-quarter or one-third of the populations of the warring nations still alive.

It is a prospect so incredible that the mind rejects it, but in order to understand it clearly we must try to visualize the details. For that purpose we must understand a few pertinent facts about the atomic bombs [Continued on page 72]

Convertible Jet Helicopter





BY GILBERT PAUST

WHEN you see a plane standing on its end in the sky—or on the ground—this will be the one!

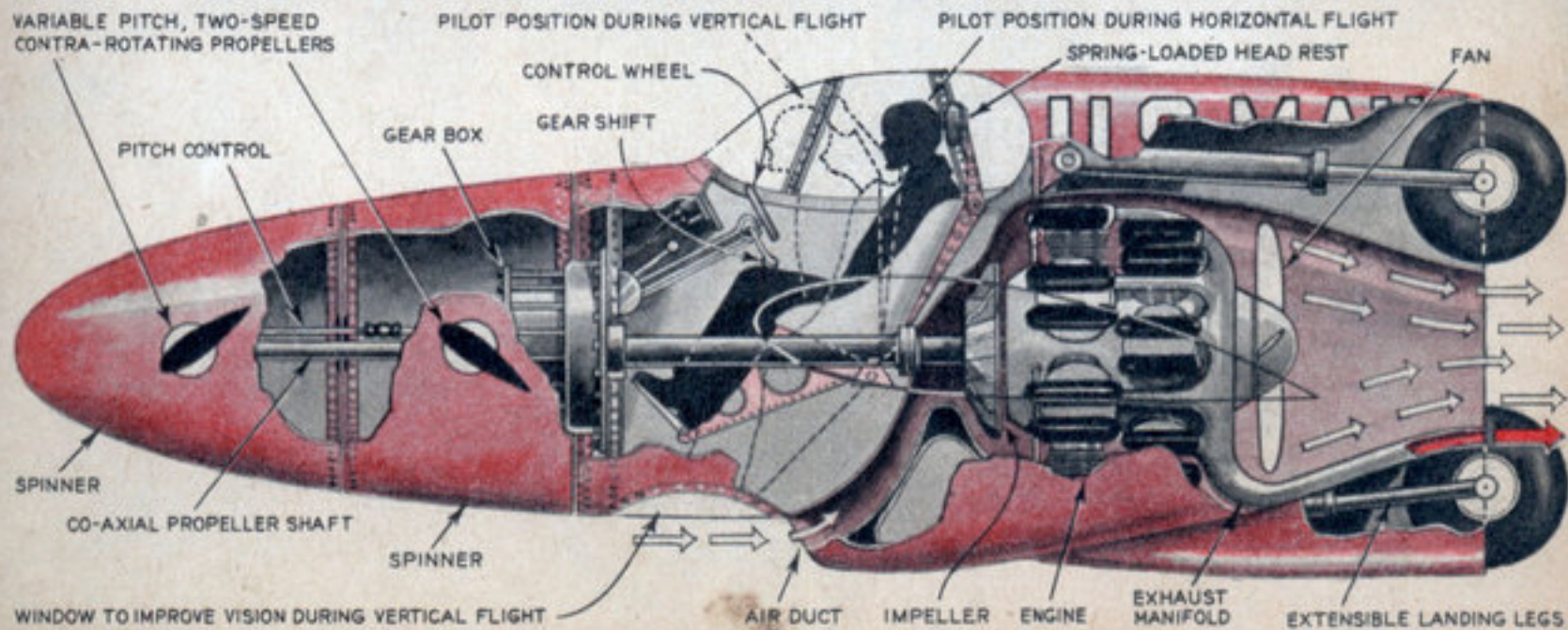
A radical new design, just granted a patent, is an airplane that can stick its nose up and act like a helicopter.

The craft has a plane's wings, ailerons and enclosed fuselage. Three wheels extending straight back to the rear allow vertical take-off and sit-down.

Contra-rotating co-axial props, larger than usual ones but smaller than rotors, lift it off the ground. Once in the air the pilot noses over and the same props pull it horizontally, like any ordinary plane. There's an extra window in the floor for the pilot to see through when flying vertically. Seats are adjustable according to the plane's position.

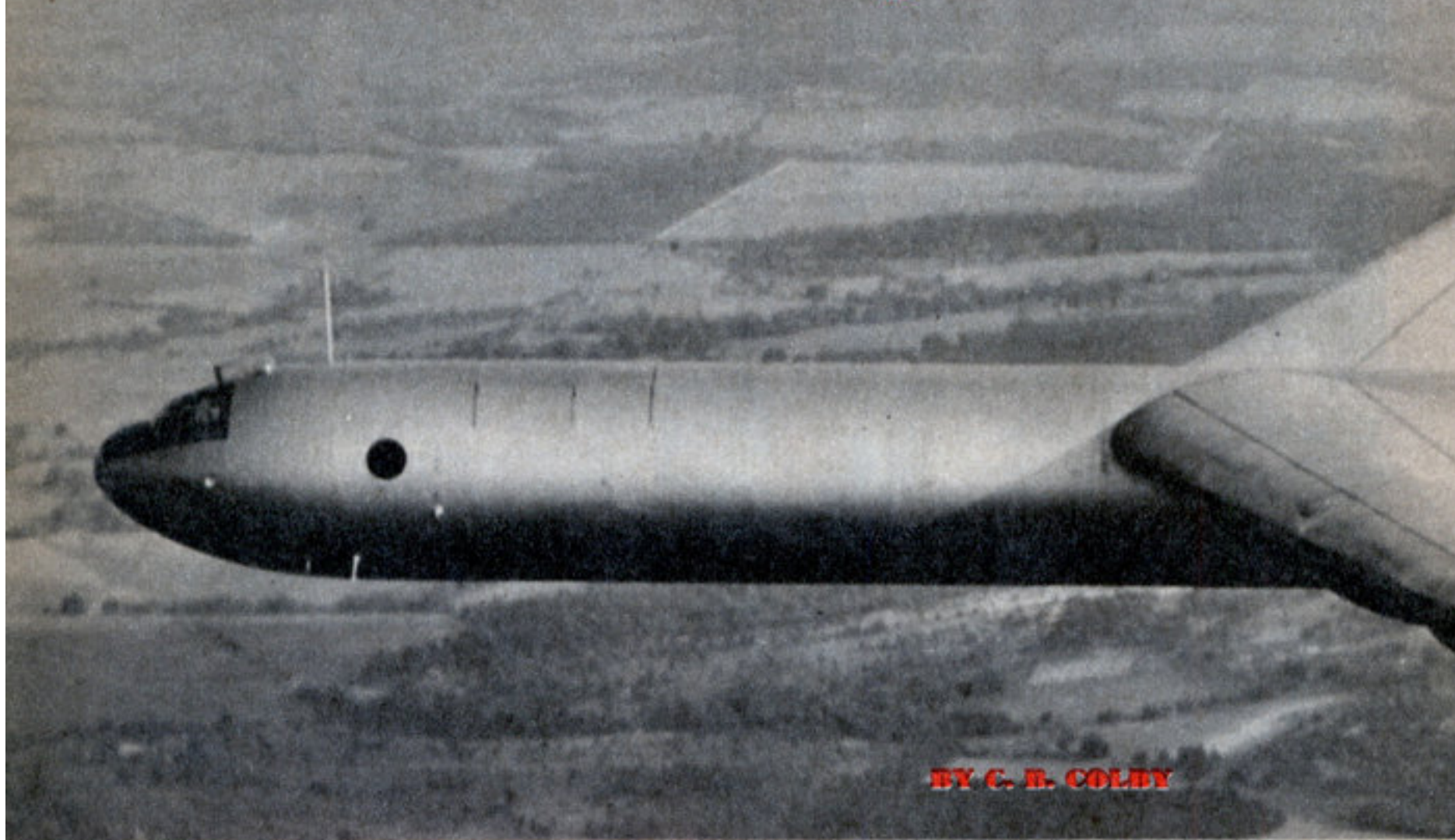
The new design allows use of small wings—which means increased efficiency at high speeds. A pitch-changing mechanism makes it unnecessary to shift gears and gives the props a big bite that increases speed.

The engine is located behind the pilot, and its jet provides useful thrust. •



ATOM-BOMBER

Carries 3 Jet Fighters



BY C. R. COLBY



The fuel capacity of the B-36 would let an auto circle earth 16 times—and tour every state.



"Fill 'er up" to a B-36 means piping in the contents of over two-and-a-half tank cars.

Meet the B-36. Its wing span is twice the distance of the Wright Brothers' first flight at Kittyhawk. It's 3 times as lethal as the B-29 and can hop to any spot on earth.

THE U. S. Air Force has a "Sunday punch" ready to slug any enemy who tries to start World War III with another Pearl Harbor.

It's a sleek super-dreadnaught of the skies, the Consolidated Vultee B-36 long range bomber—and it's ready today to exploit to the fullest the awesome power of the atomic bomb. Carrying its own fighter protection in its belly, it will serve, in the event of war, as the "throwing arm" for the most destructive force in history.

The new air giant dwarfs even the mighty B-29 Superforts of World War II, in both size and performance. And it's a space shrinker. It should dampen the war-



We get a slight idea of the size of the new colossus of the skies when we see it alongside its 66-foot predecessor, the C-87 Liberator.

The production model of the B-36 carries eight 56-inch wheels to distribute its 278,000 lbs. at landing. Early models had 2 110-inch wheels.

ring ambitions of aggressive nations anywhere in the world.

Brigadier-General Roger Ramey, commanding officer of the Eighth Air Force, soon to become the most powerful air unit in the world through acquisition of a fleet of B-36's, says this about their performance:

"From the North American continent, they can strike anywhere in the world where aggression against us could start."

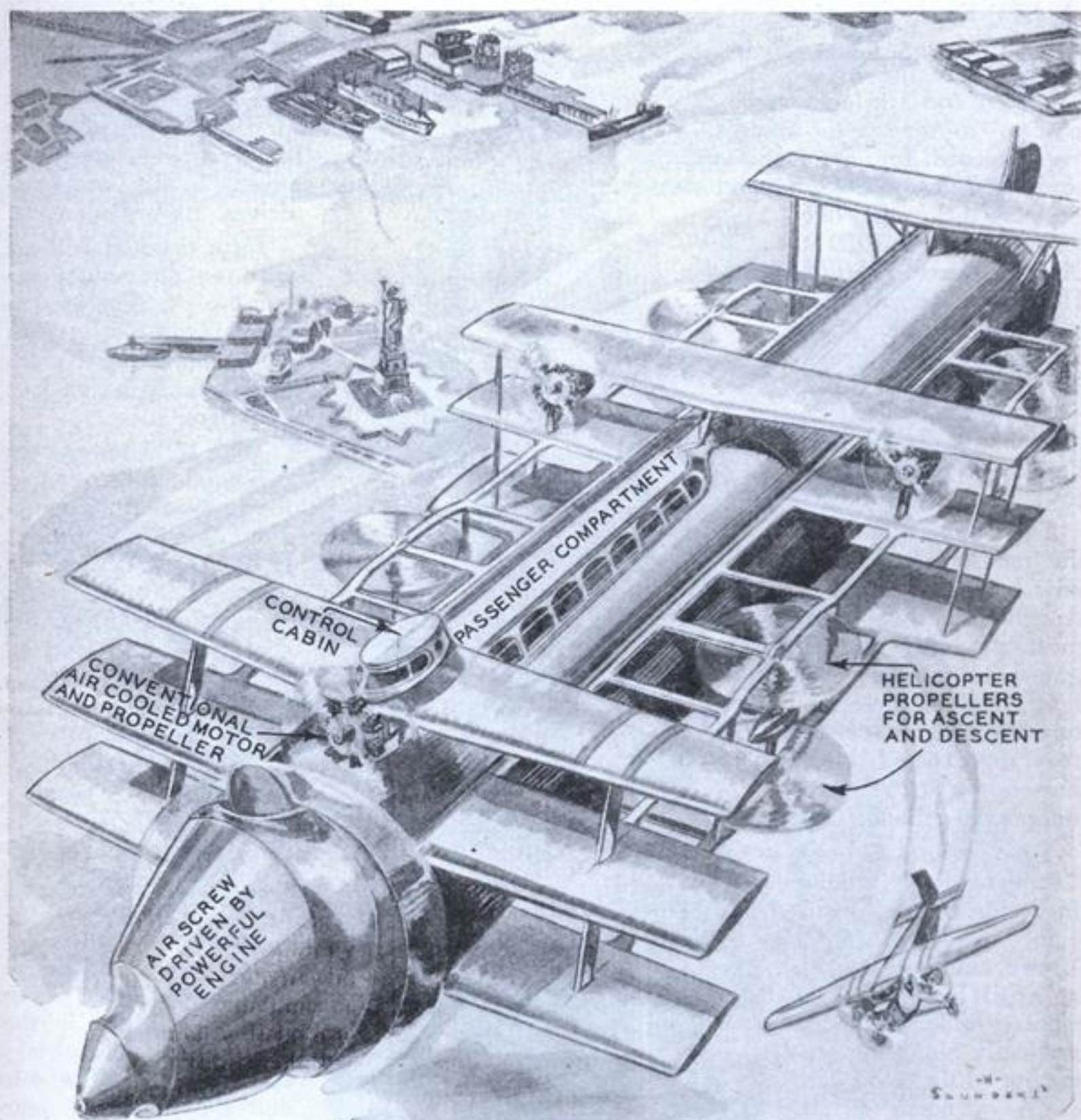
The bomber is so designed that "there is nowhere in the world that can't be bombed" from North America, according to General Ramey, "when combat





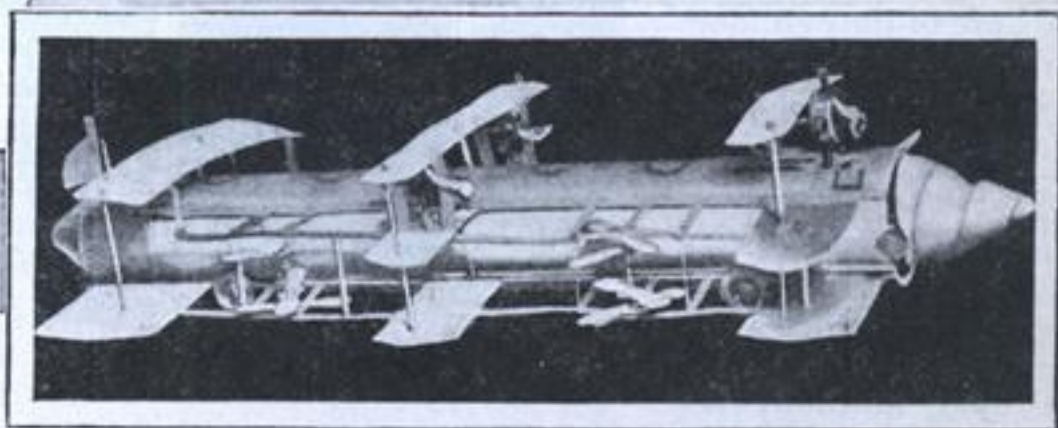
The mammoth bomber carries her own "parasite" fighters. The bomb bay will hold three McDonnell XP-85's, 15-foot jet fighters with a top speed of better than 650 mph and a ceiling above 45,000 feet. These tiny planes have no landing gear! After trans-sonic battle they return and latch on to the mother ship with their "sky hooks," as seen in the picture. The wings can fold up for compact storage.

The FREAK of the Month ~ No. 2



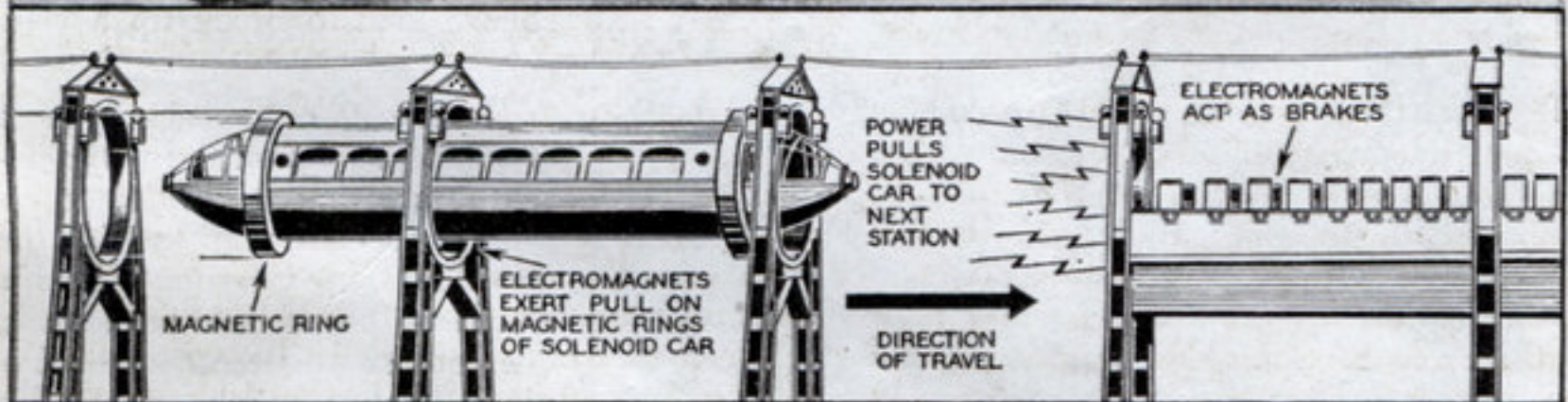
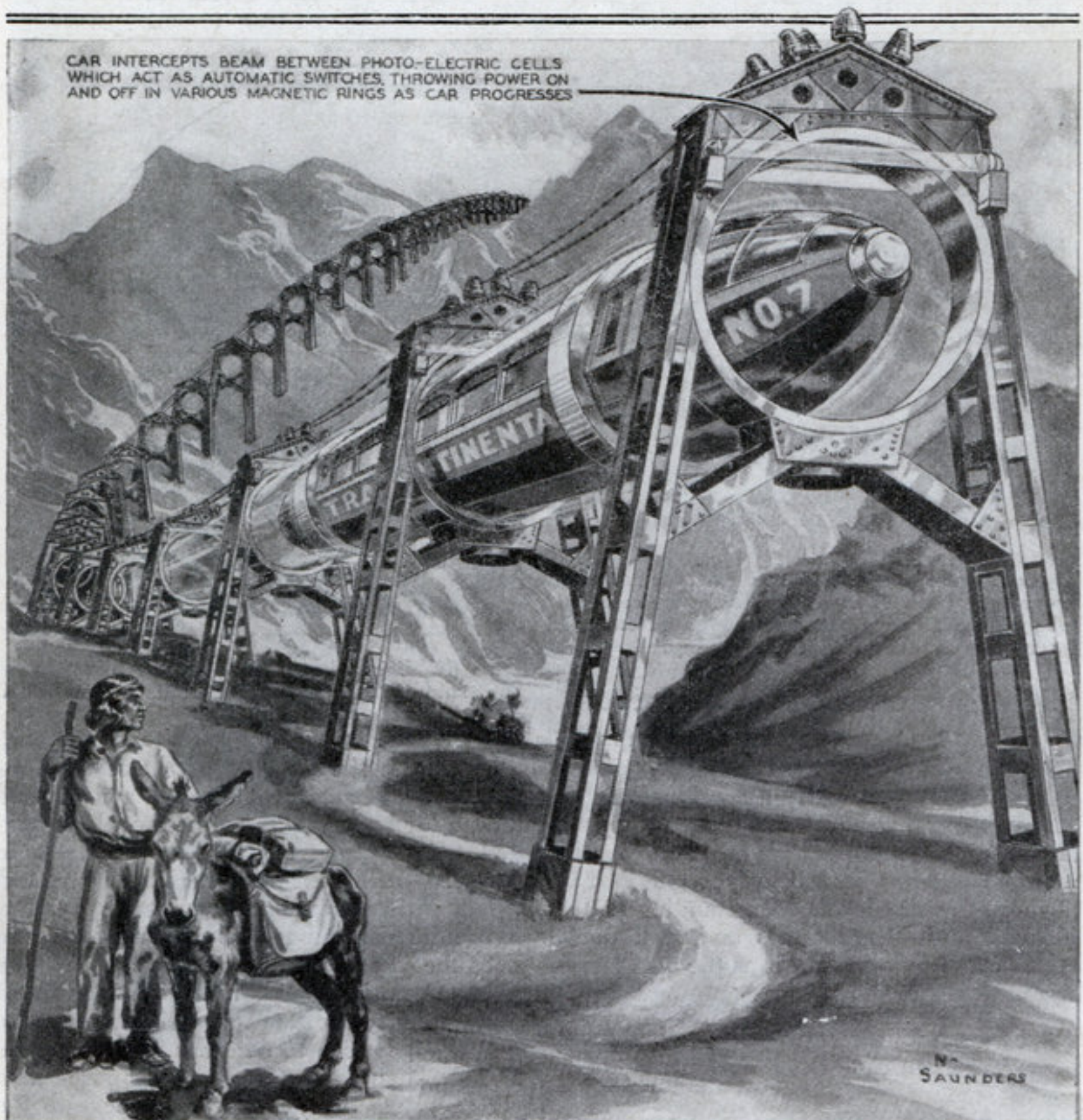
An artist's conception of Mr. Knott's air liner.

THE most unusual design brought to our attention this month is the air liner invented by Mr. R. Knott of Lewisham, England, who hopes to cross the Atlantic with a ship of this type carrying 600 passengers in from 12 to 15 hours.



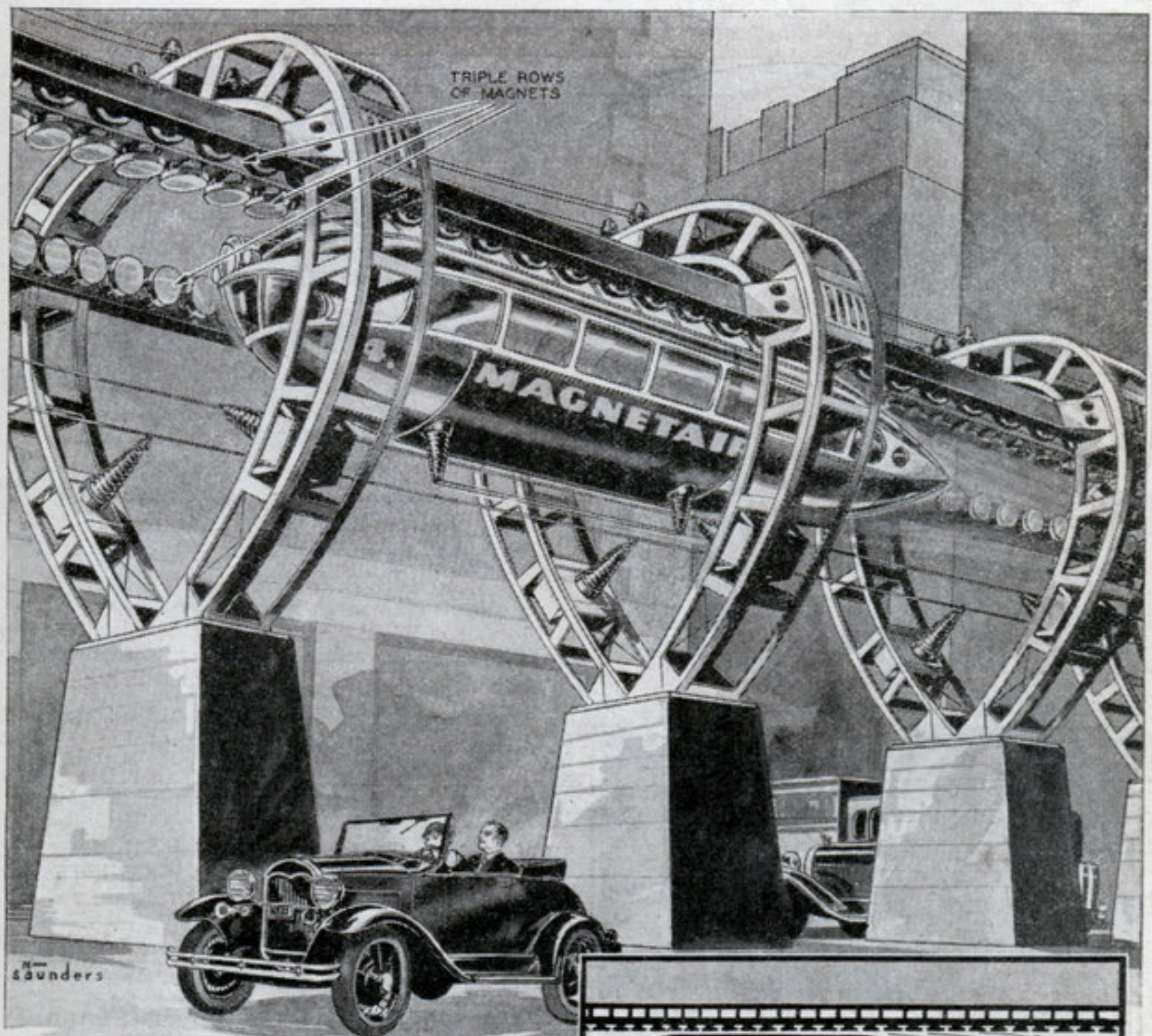
Here is a photograph of the model of this unusual ship which the inventor calls a heliplane. With eight horizontal propellers, the plane is supposed to be able to rise straight off the ground without any preliminary run and to land safely in almost its own length.

Magnets Drive High Speed

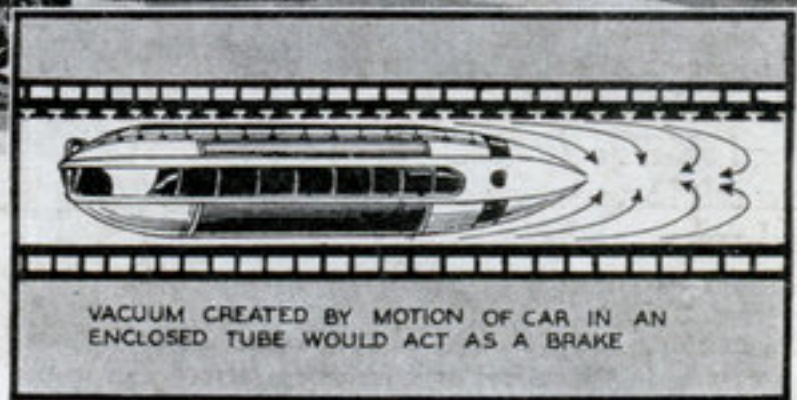


The artist's drawing at top illustrates the solenoid rapid transit railway now being developed by German engineers. Cars speed forward under power of giant solenoids exerting powerful pull on magnetic rings around the cars. Current to next solenoid in line is switched on automatically when fast moving car intercepts light beam from photo electric cells. Diagram shows operation of solenoids.

Suspension Trains Thru Air



Proposed overhead railway with cars driven by triple rows of magnets is illustrated here. Magnets are cut in circuit progressively at central power house to pull cars forward. Diagram at right shows why cars could not be run in an enclosed tube, because of vacuum braking effect.



ELEVATED trains whizzing at tremendous speed from city to city, powered solely by electromagnetic lines of force, is the new and startling method of rapid transportation now being developed by German engineers.

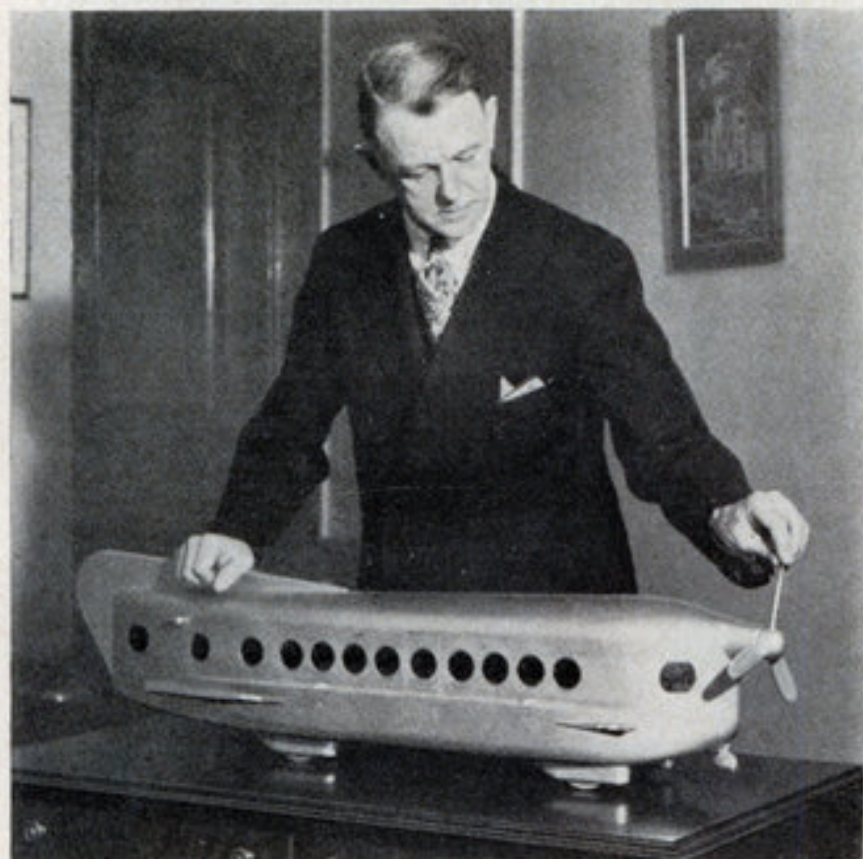
A war against friction losses has long been waged by scientists; and this electromagnetic rapid transit project now promises to end the conflict. No wheels are to be used for traction. The cars are drawn forward, in one scheme by powerful electromagnets, in the other by huge solenoids.

Cars on the solenoid railway are to be equipped with giant magnetic rings, as illustrated on the opposite page. Power is switched on to the solenoids automatically as the car progresses by means of photo-electric cells operating at moment beams are intercepted.

Speed of the electromagnet cars is regulated at the central power station by a revolving switch which cuts the magnets in the circuit like electric lights in a display sign. Connections through wireless enables operator to give stop or start signals.

Gliding Cars Planned

TRAINS THAT WOULD SKIM TRACKS AT HIGH SPEEDS PROPOSED IN



Walter H. Judson, inventor of the flying railroad, with a model of the high-speed coach. The reversible propeller acts as a brake

IMAGINE a flying railroad in which captive airplanes serve as cars. Skimming through the air, the streamlined cars are expected to attain speeds up to more than 200 miles an hour. A cage of rails restrains them from actually leaving the track.

That is a brief outline of a project for a high-speed transportation system put forward by a New York engineer, Walter H. Judson, pioneer aviator and formerly chief engineer for a railway car manufacturer. In Judson's opinion, all engineering details have been worked out. With the cooperation of makers of railway and electrical machinery, structural steelwork, and airplane equipment, he has prepared a complete plan.

Judson's plan calls for a light-weight structure of steel with a roadbed of trough-shaped cross section. Two bottom rails will be faced with rubber; these will support the flying car, with its pressed-steel wheels, while it lightens itself with increasing speed. A pair of side rails will serve as buffers and prevent sideways. L-shaped rails at the top will complete the cage and prevent the car from lifting itself completely from the track.

The fifty-foot coach, encased in a streamlined shell of light metal alloy, will resemble an airplane fuselage shorn of wings. Wind-tunnel tests show, Judson says, that the curvature of the roof provides sufficient lift at full speed to raise nearly all of the car's weight from the

This cut-away picture shows the details of a high-speed car such as is proposed for the unique rail line. Note the guard rails and the wheels that would permit the car to rise clear of the tracks in safety

rails. Guide wheels with rubber tires are expected to restrain the car if it should leave the rails entirely, while similar wheels limit sideward movement.

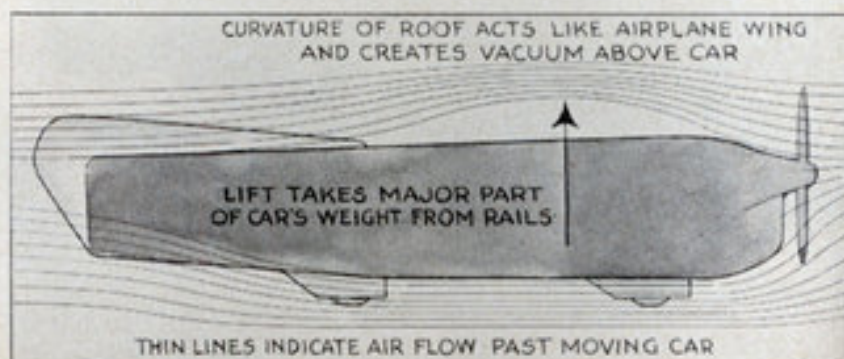
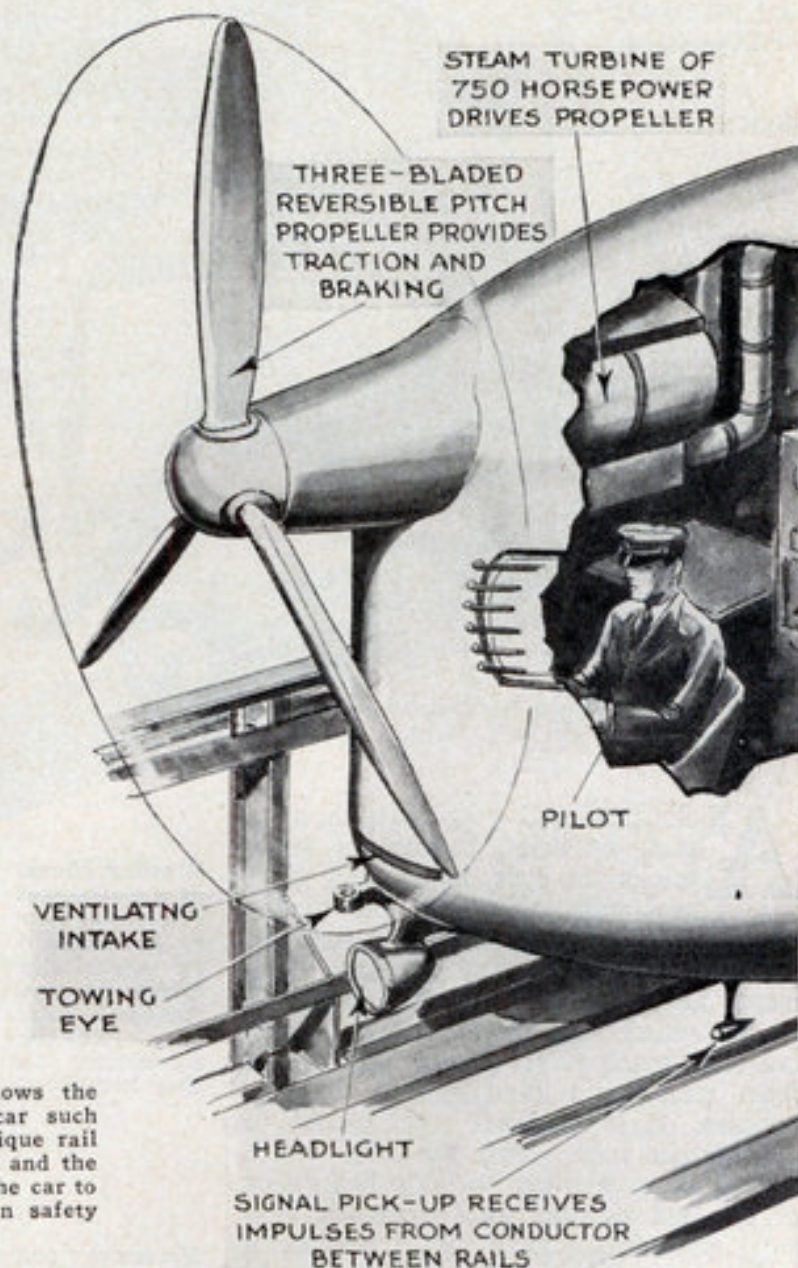
A compact geared turbine will drive the propeller. Steam is supplied from an oil-burning boiler in a rear compartment, and exhaust steam from the turbine will pass through a condenser, enabling most of the water to be recovered and used over again.

The coach Judson plans would accommodate from thirty-six to fifty-four passengers. Its crew would consist of pilot, mechanic, and porter. There is no conductor.

For transcontinental service and other long hauls, Judson proposes the use of a flying train of from three to ten coupled sections, instead of

the individual coach. A power car at the front would pull a string of passenger or freight-carrying sections, ending in a tapered observation car or caboose, at from 100 to 180 miles an hour Judson says. The cars will be coupled in such a way as to avoid wind drag from vacuum pockets forming between them.

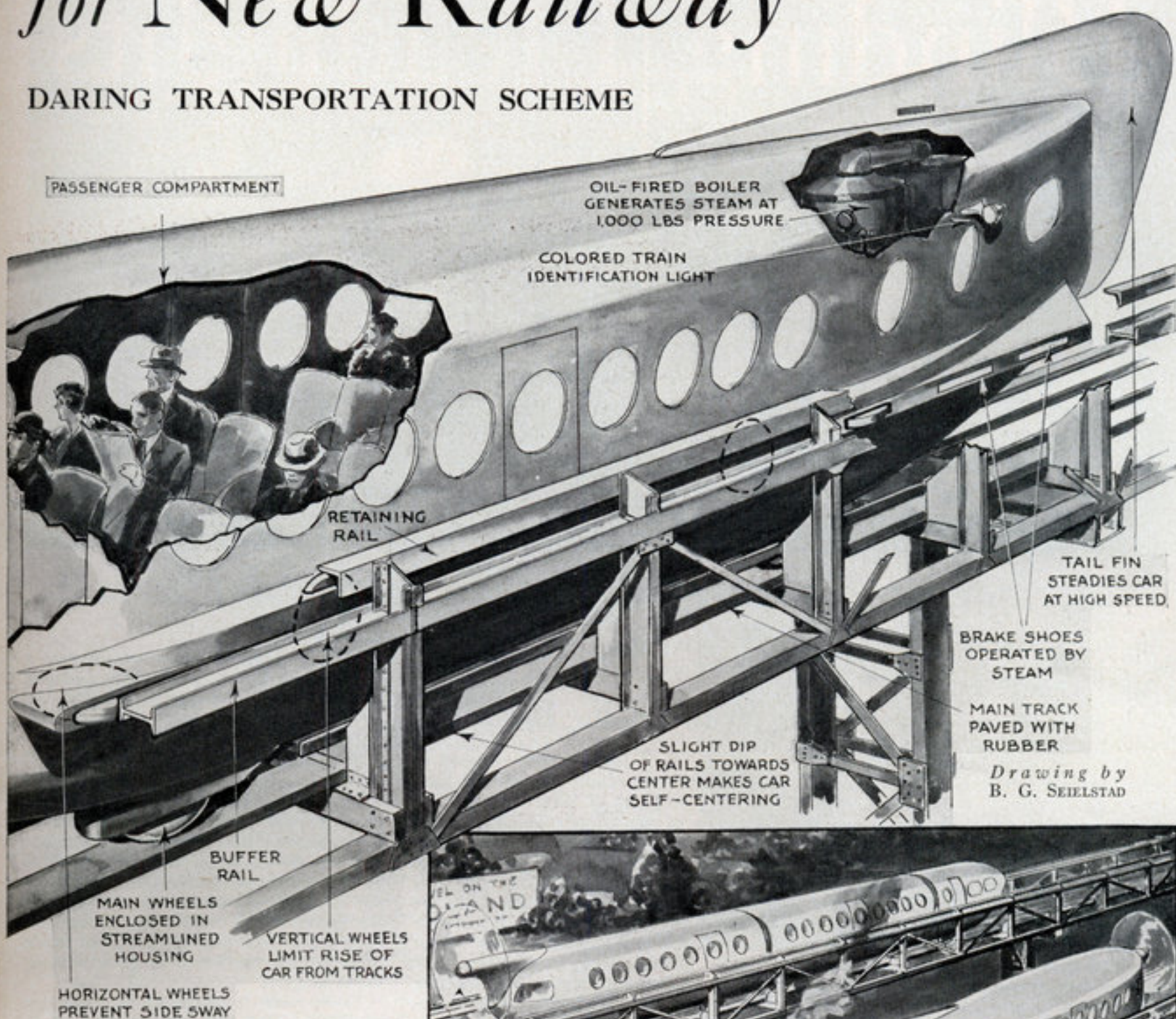
Since an ordinary brake would quickly burn out if applied to a vehicle traveling at such speed, the propeller will be made to serve as an air brake. This will be done



Curvature of car's roof exerts a lift at high speeds, like an airplane's wing, tending to make car rise from the tracks

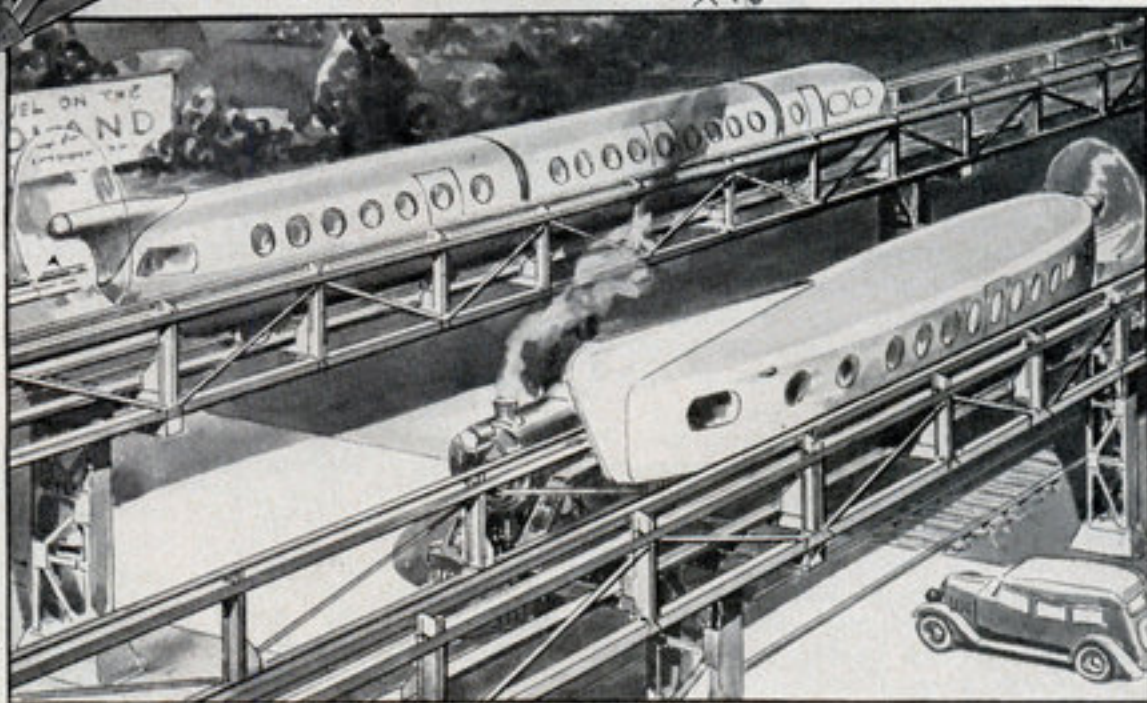
for New Railway

DARING TRANSPORTATION SCHEME



by reversing the pitch of the propeller blades so that they push the air ahead of the car and retard its motion. When the vehicle has thus been slowed to ninety miles an hour, steam-operated brakes will be applied to I-beams at the sides of the trough and bring the car to a halt. A full stop from a speed of 200 miles an hour can be made in 7,800 feet, Judson calculates.

An automatic signal system, he says will make it impossible for one car to approach closer than three miles' distance to another. When a danger signal is picked up electrically from an inductor cable running along the center of the trough, the propeller blades will reverse of their own accord and the steam brakes operate after the proper interval. If any foreign object falls into the runway, an emergency signal is automatically flashed to oncoming cars and the usual action of the propeller brake is accelerated. The pilot has no signals to watch, but can talk with other cars and with the train dispatcher through a "wired wireless" system using the same conductor that carries the



An individual coach for short runs and, in rear, a streamlined train for long hauls

signals. These safety features and the absence of any grade crossings greatly reduce the chance of accident, Judson believes.

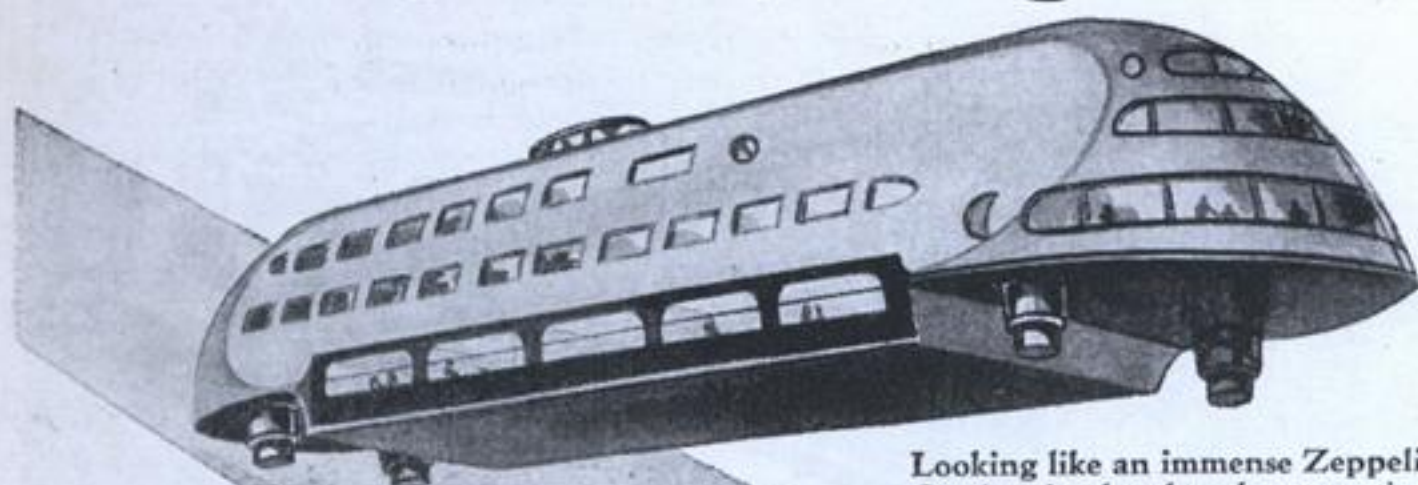
Windows will be sealed and fresh air provided by an air-conditioning system with an inlet at the front of the car.

Judson announces that a fifteen-and-a-half-mile demonstration line is planned for New Jersey, to serve a community as yet unnamed. Both coaches and trains will be run according to the plan, and will make the trip to a terminal connecting

with a New York ferry in six minutes. Commuters and sightseers, Judson says, will be offered an opportunity to use the line, although its principal purpose is to show the feasibility of the system for larger-scale application. He declares its use would bring Chicago within five and a half hours of New York City, and San Francisco eighteen hours from New York.

First of the longer runs contemplated by Judson for his system are lines connecting Jersey City and Atlantic City, N. J., with Philadelphia, Pa.

Strange Lifting Force



How does this airship keep aloft with neither propellers nor lifting gas? It's the strangest craft yet designed to cruise the skies and represents as far a departure from conventional types of aircraft as can be imagined. You'll find this description of the ship fascinating.

Looking like an immense Zeppelin hangar floating in the sky, the gyro-airship, with an immense load-carrying capacity and tremendous speed, bids fair to put railroads out of business as freight-carriers if the hopes of its inventor are justified.

WHAT is certainly the most unique airship in the world is now under construction in the form of an experimental model in the factory of its inventor in Denver, Colorado. As depicted on these pages, the extraordinary ship will use neither propellers nor gas to keep it in the air, but will depend on a mechanism which its inventor, Edgar R. Holmes, calls the "gyradoscope".

Each horsepower of gyradoscope is expected to lift 1,000 pounds vertically in mid-air and sustain the load at any desired elevation by regulating the speed, and the inventor expects a machine weighing 2,000 pounds to lift 500 tons.

Briefly, the gyradoscope combines gyroscopic action with centrifugal force. As described in the prospectus of the company, the gyradoscope consists of two wheels rotating in opposite directions in the same plane. Each wheel has several weights, the arms of which are connected to eccentrics on each wheel, which propel the weights in opposite directions in such a way that a lifting effect is exerted when the weights are at the top point of travel.

The exact mechanism by which this effect

is produced is somewhat obscure, but a model of the device already built has been bolted to the floor of a freight elevator, it is claimed, and succeeded in raising and lowering it with ease. In this test a 20-horsepower gasoline engine furnished power.

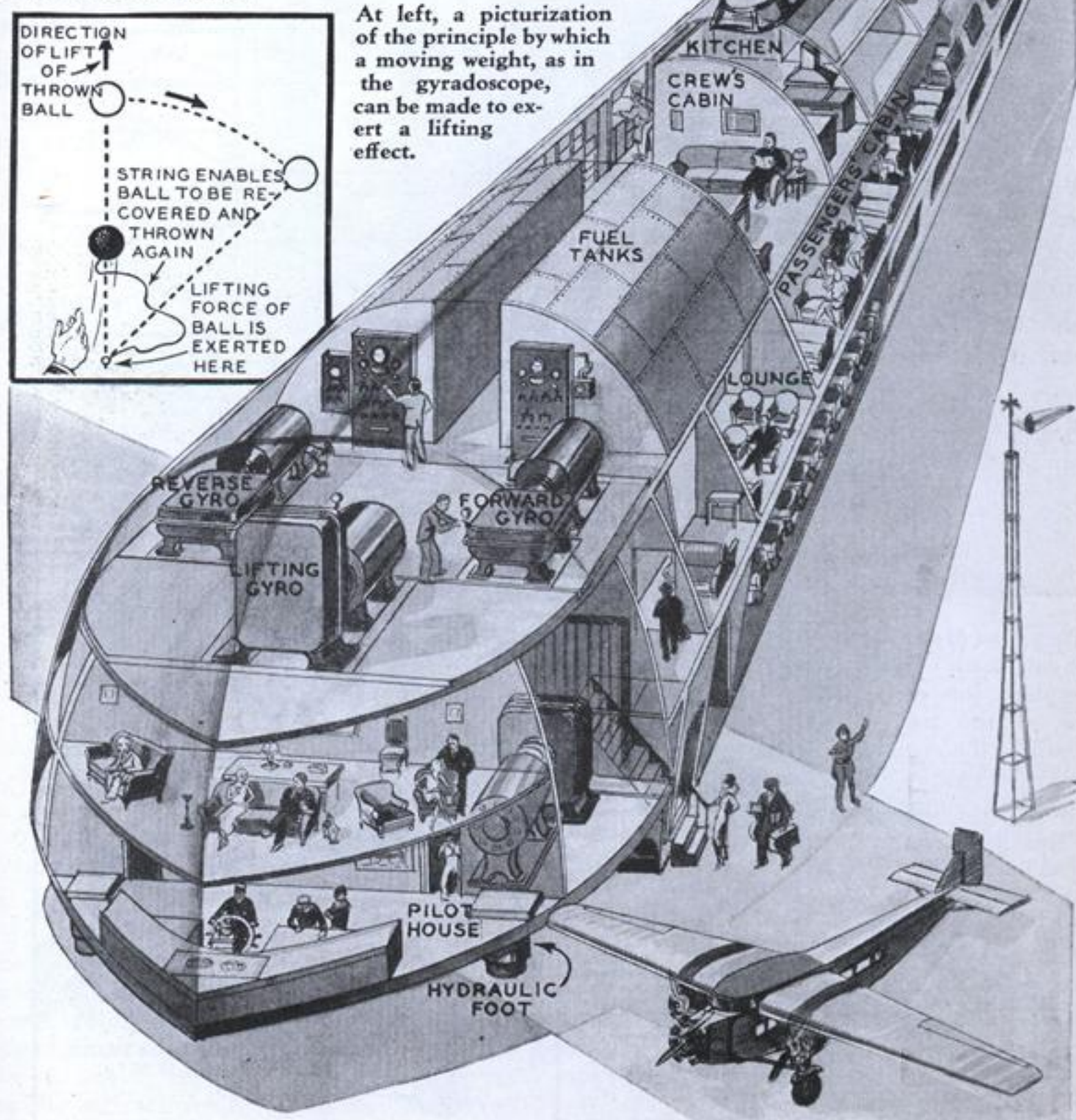
Lifting force exerted by the gyradoscope is likened to that of a ball thrown on the end of a string. The weight of the ball at the moment it draws the string taut exerts a lifting effect on a pencil or other object to which the bottom of the string may be tied. In the gyradoscope the moving weights on the wheels are analogous to the thrown ball. To a casual scrutiny the whole idea seems very much like lifting one's self by one's boot straps, but the success attained with models indicates that the inventor may be successful in developing an entirely new type of aircraft.

Forward motion is to be supplied by a gyradoscope in horizontal plane, and steering will be accomplished by a similar mechanism. In case of accident to the lifting gyros, which would result in the ship's dropping

Used in Novel Airship

like a plummet, auxiliary machines are provided which are kept running at idling speed ready to be called upon in an emergency. Four hydraulic landing feet, one on each corner of the ship, absorb the shock of landing, which is expected to be insignificant since rate of descent is controlled by speed of the gyroscope. Mr. Holmes, inventor of the gyro-ship, also has the invention of a popular front wheel drive for autos to his credit, as well as a four wheel drive and a caloric steam engine.

This latter machine would supply the power for the airship. As developed by Mr. Holmes, waste heat from oil combustion is used in the caloric engine to convert water into steam, which drives a turbine, and is then condensed to be used over again.



At left, a picturization of the principle by which a moving weight, as in the gyroscope, can be made to exert a lifting effect.

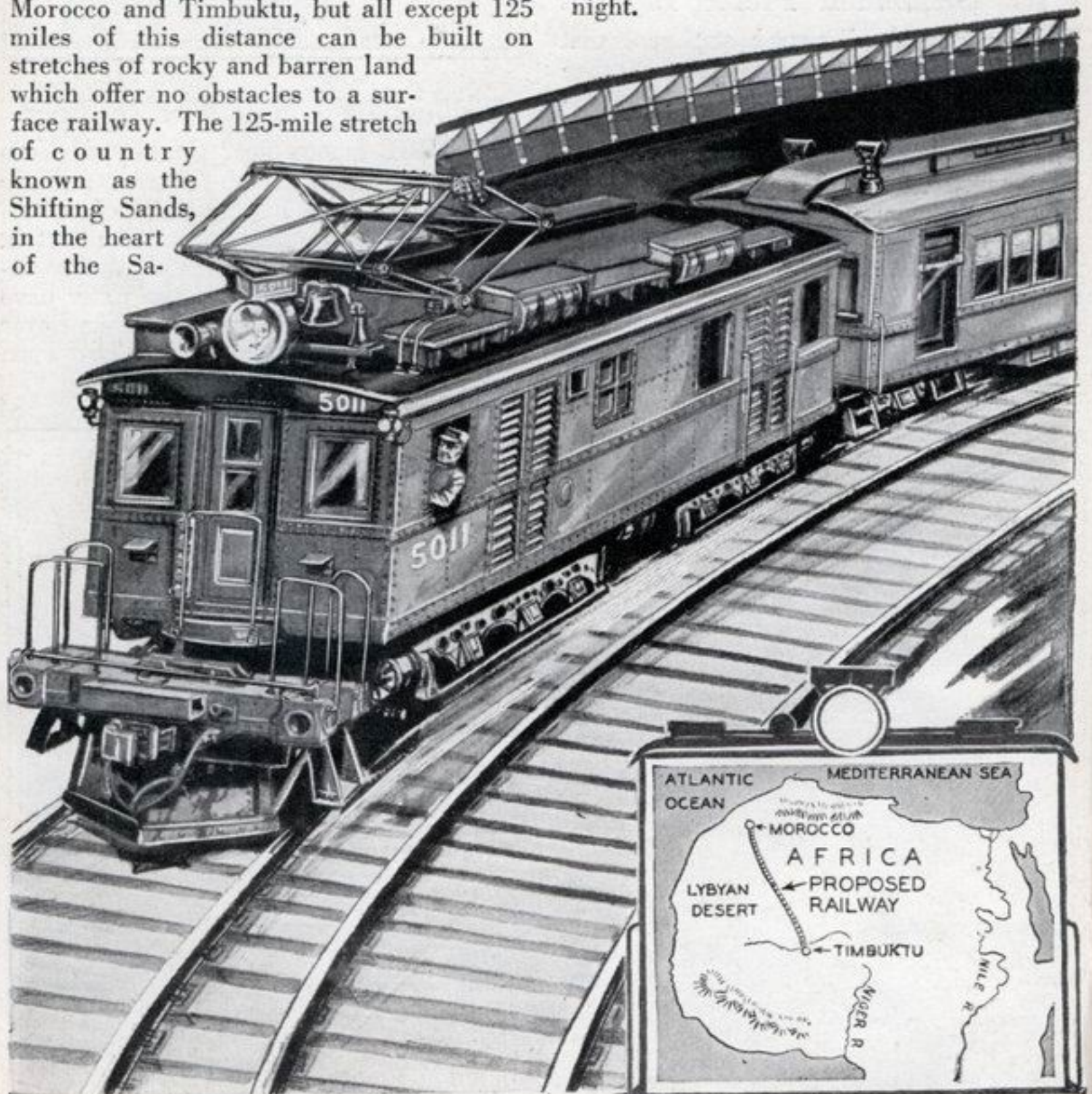
Above is a phantom view of gyro-airship, planned for production, showing arrangement of parts.

A SUBWAY Through

A tunnel railway beneath the shifting Sahara desert sands of northern Africa, covering the thousand miles between Morocco and Timbuktu, is proposed by a French engineer as a solution of desert travel.

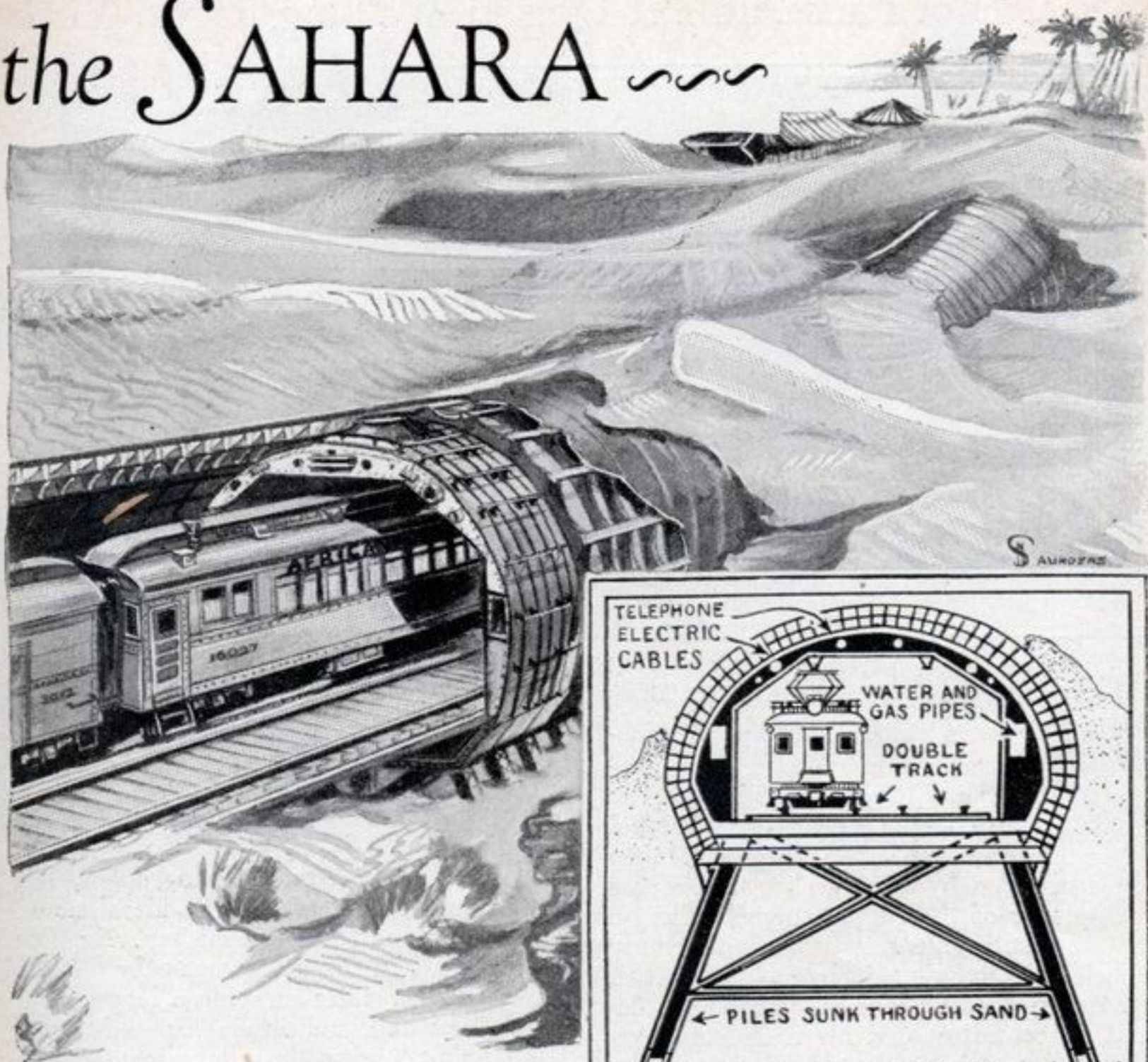
COINCIDENT with the project of a tunnel under the English channel to connect France and England, a French engineer, Paul Remy, has conceived the idea of a 125-mile subway through the Sahara desert in northern Africa. The route of the railway would cover the 1000 miles between Morocco and Timbuktu, but all except 125 miles of this distance can be built on stretches of rocky and barren land which offer no obstacles to a surface railway. The 125-mile stretch of country known as the Shifting Sands, in the heart of the Sa-

hara, is filled with sand dunes which blow up overnight to tremendous heights, only to disappear on their endless march where the hot winds bore through them and urge them onward. Surface rails, of course, would be impossible in this land where mountains of wind-blown sand would cover them overnight.



The map printed above shows a proposed route of trans-Saharan railway tunnel. From Morocco to Timbuktu the distance is just over 1000 miles, but the tunnel would only be necessary for a stretch of 125 miles in the middle point of the distance. The remaining tracks would be built regularly.

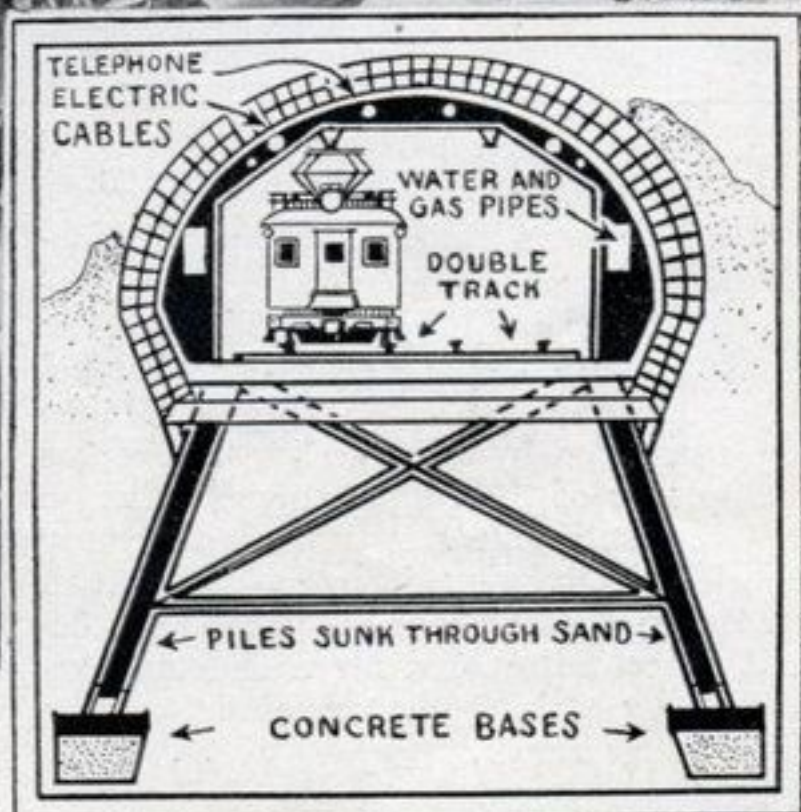
the SAHARA ~~~



For this reason Remy's tunnel project seems the only practicable idea yet advanced for speeding up desert travel. As proposed, the tunnel would be a huge metal tube supported on a skeleton viaduct of cross-ties and piles sunk into the sand.

It would be a simple task to construct pipe lines through the shell of the tube so that water, gas, electric cables and telephone lines could be run through them. Power for the trains would naturally be electric, since it would be impossible to use coal or oil-burning locomotives because of the ventilation problems involved.

In time the desert sands would submerge the tunnel entirely, insulating it from the intense heat so that travel would be far more comfortable inside the tunnel than upon the surface. Were it not for the fact that there is no water available, it would be possible to plant grasses in the sands and



Observe how the supporting piles of the tunnel are sunk deeply in the sand, resting on spread-out bases. Telephone and electric cables run inside the shell of the tunnel.

anchor them with plant growth so that they could not shift overnight. As it is, however, the tunnel seems to be the only possible means of bridging the heart of the desert.

Fantastic as such a scheme sounds at first, and high as would be the initial cost, no other entirely satisfactory method of rapidly crossing the shifting sand area has been offered. For both economic and military reasons France is determined to build a railway across the Sahara. Some means of rapid transport of troops in case of a national emergency, is very desirable.

Wonder Subway Built Under



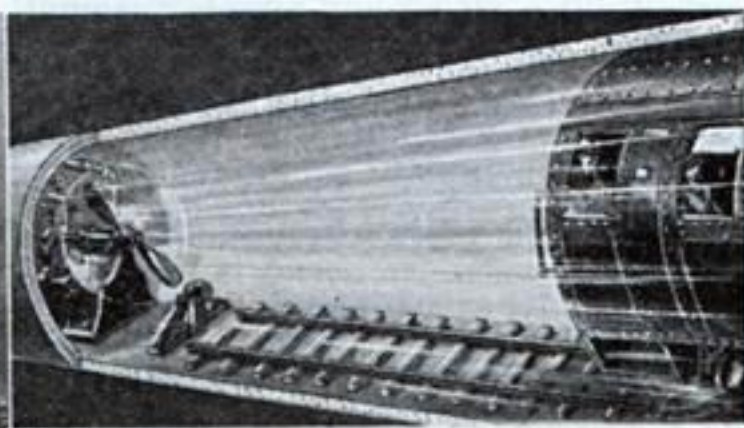
This 724-ton monument to Columbus was propped up with hydraulic jacks while the new subway burrowed beneath it.

Propping up multi-storied skyscrapers on stilts, burrowing beneath railway tunnels, digging out huge chunks of solid rock, thousands of workmen have just completed the most amazing engineering job of its kind on record—the construction of New York City's newest subway, which is the very last word in underground transportation luxury.

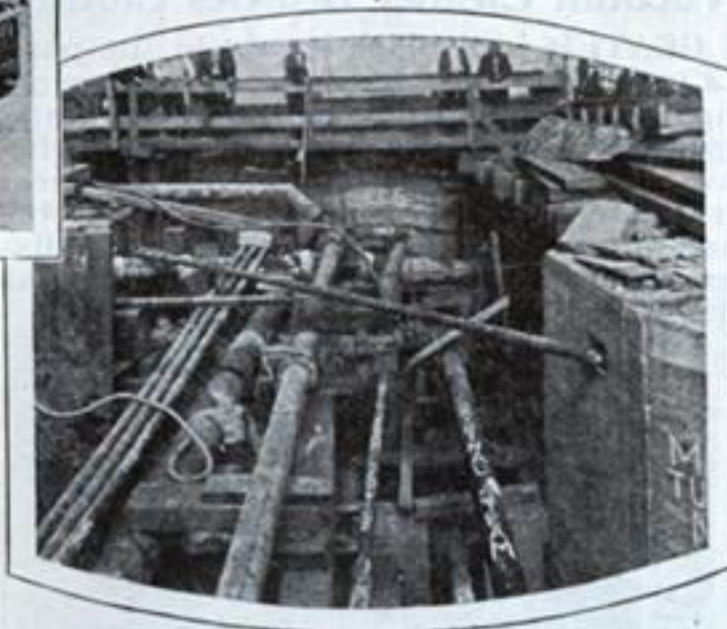
by THOMAS M. JOHNSON

ONE winter day 62 years ago, wheels turned in the first underground railway ever operated in an American city. Really it was a block-long subterranean pneumatic tube, through which a steam-driven fan blew a single 18-passenger car, then sucked it back. Twenty-eight years ago the first train ran on a permanent American subway; a work-train of wooden-railed flat-cars, but it began an epoch that has greatly changed life in many large American cities.

This modern epoch of subways culminated where it began, in New York City, at 12:01 September 10, 1932, in the opening of the world's newest subway, which has also been called its most superlative subway. It is the first completed link in a great and unique new chain, the only railroad under, upon or above ground in the Greater City, that is built and operated by the city itself. Its building has embodied every lesson learned in underground railways since



First American subway, only one block long, was blown back and forth by steam-driven fan.



One accidental blow of a pick by a subway workman would have severed one of the underground arteries which mean life to New York City. The photo shows the gas mains, telephone cables, steam pipes, water mains, and electric lines, which hampered the subway builders.

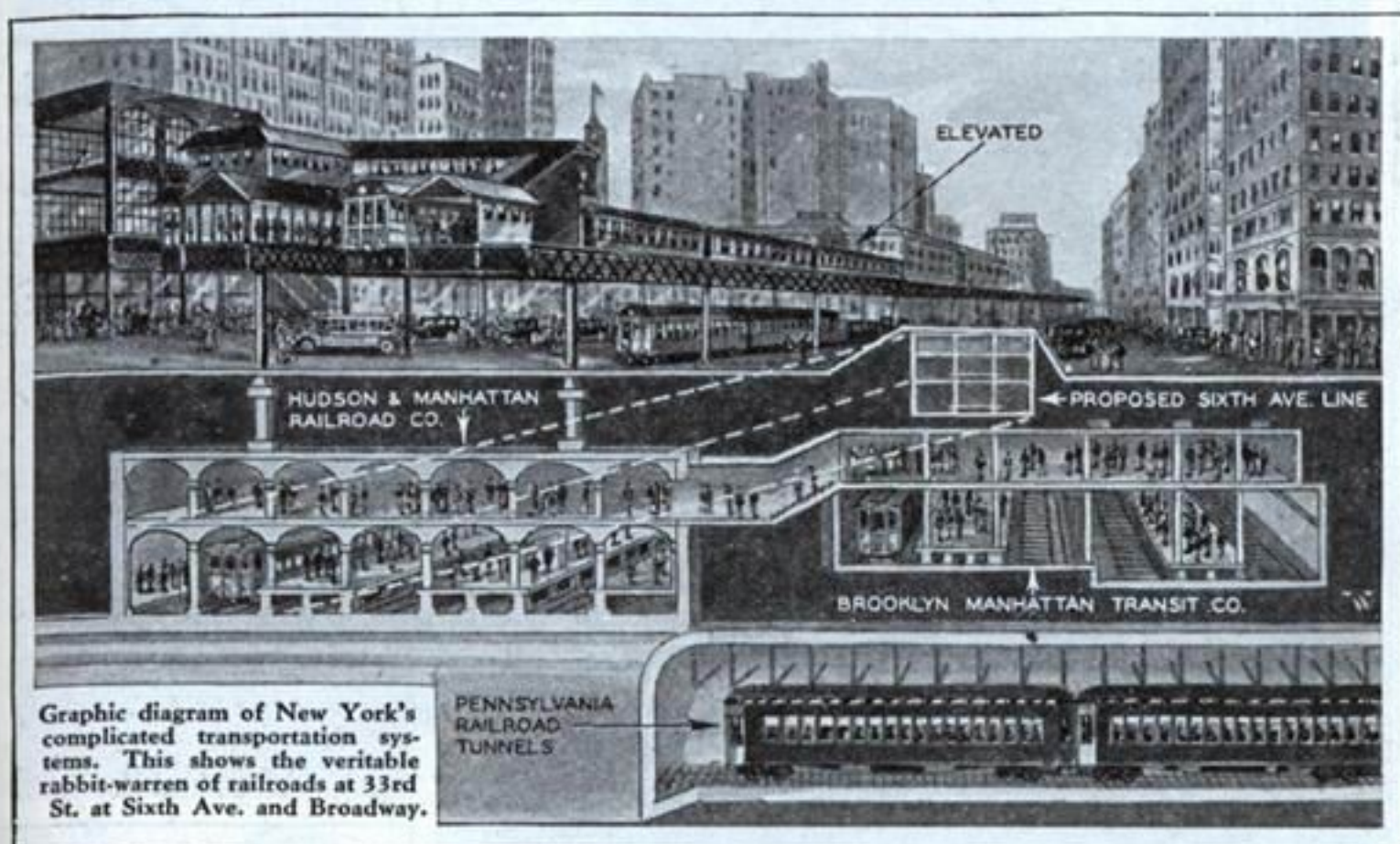
1870, and experts from all over the world have come to see it.

The most superlative single feature of the new Eighth avenue subway is already drawing crowds. It is the station at Forty-second street, near the theatrical and hotel district. This is the biggest underground station in the world, with twice the capacity of London's famous Piccadilly Circus station. It is 1,200 feet long, the platforms extending under five, and mezzanines under four, of the busiest city blocks in the world. This station will also connect underground with the subway that crosses Manhattan and the East River to Queensboro on Long Island.

To build the world's biggest subway station was a giant engineering feat, made more difficult by the fact that Manhattan Island is almost solid rock, with a thin coating of soil. So for every cubic yard of earth excavated, there had to be $2\frac{1}{2}$ cubic yards of rock, the totals being 45,000 and 111,000 or 156,000 cubic yards in all. But there was more to it than that.

There were great skyscrapers and other

SKYSCRAPERS on Stilts



smaller buildings to be underpinned so they would not fall crashing into the pit, and a myriad sorts of accidents to be averted by careful handling of the water mains, sewer lines, gas pipes, power cables (of which there were 100) and 15,000 pairs of telephone cables. Then once these dangers had been met and the hole safely dug, into it had to go 15,795 cubic yards of concrete, and 4,000 tons of structural steel. And that was only one station of the 28 on the new subway.

In the finished Forty-second street station are several features that are superlatively new. There is a new lighting system, to eliminate shadows entirely in this thronging crossroads underground. There is improved ventilation. There are no curved station platforms, all are straight-edged, to cut down accidents, especially to passengers slipping as they get on and off trains. There is a new plan of wall decoration, with tile in colors varying with the parts of the route, to help prevent passengers missing their stations.

For the passengers, also, has been developed what transit experts say is the most superlative subway car in the world. It was designed by a picked board, who were told:

"Here, fix us up the best car that runs underground. Go the limit."

The result is the dark-green steel car, painted "City of New York," of which 300 are now roaring up and down the subter-

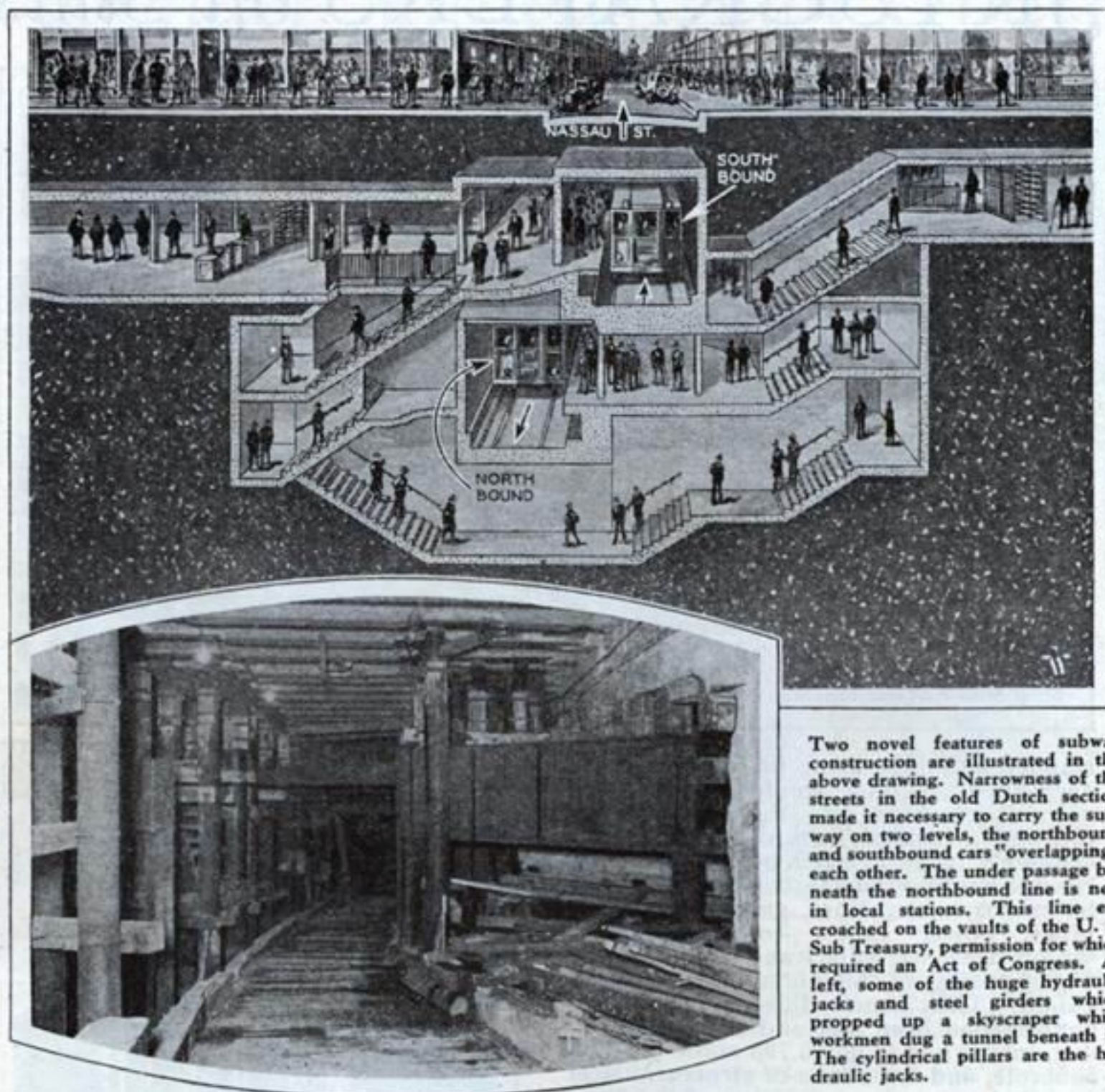


Outside and inside views of the special cars designed for the new subway. They hold 280 passengers each, and are fitted with four doors on each side to speed up entry and exit.

anean galleries. Each car is 60½ feet long, 10 feet wide, and 12 feet high. There are five fans in the ceiling, and ventilation shutters so arranged that air passes continuously in one side, and out the other. The car is lighted by 22 bulbs, each wired independently, and four emergency bulbs, which go on when power goes off. All bulbs are "left-handed"—a mean trick on pilferers.

But to the passenger, be he visitor or New

Two-level Construction, Underpass, Are Novel Features of New Subway



Two novel features of subway construction are illustrated in the above drawing. Narrowness of the streets in the old Dutch section made it necessary to carry the subway on two levels, the northbound and southbound cars "overlapping" each other. The under passage beneath the northbound line is new in local stations. This line encroached on the vaults of the U. S. Sub Treasury, permission for which required an Act of Congress. At left, some of the huge hydraulic jacks and steel girders which propped up a skyscraper while workmen dug a tunnel beneath it. The cylindrical pillars are the hydraulic jacks.

Yorker, the greatest improvement will seem to be that he can get on and off the new cars more quickly than the old—which, of course, means shorter waits at stations, and quicker runs. Although the new cars are seven feet shorter than the type hitherto newest, they can be loaded and unloaded in one-third less time. And they hold 40 per cent more passengers than the cars still running on the original I. R. T. New York subway. Of the 280 passengers a new car will hold, only sixty will be seated, while 220 stand, and of the 220 only 52 will have the support of the white porcelain grips or stanchions.

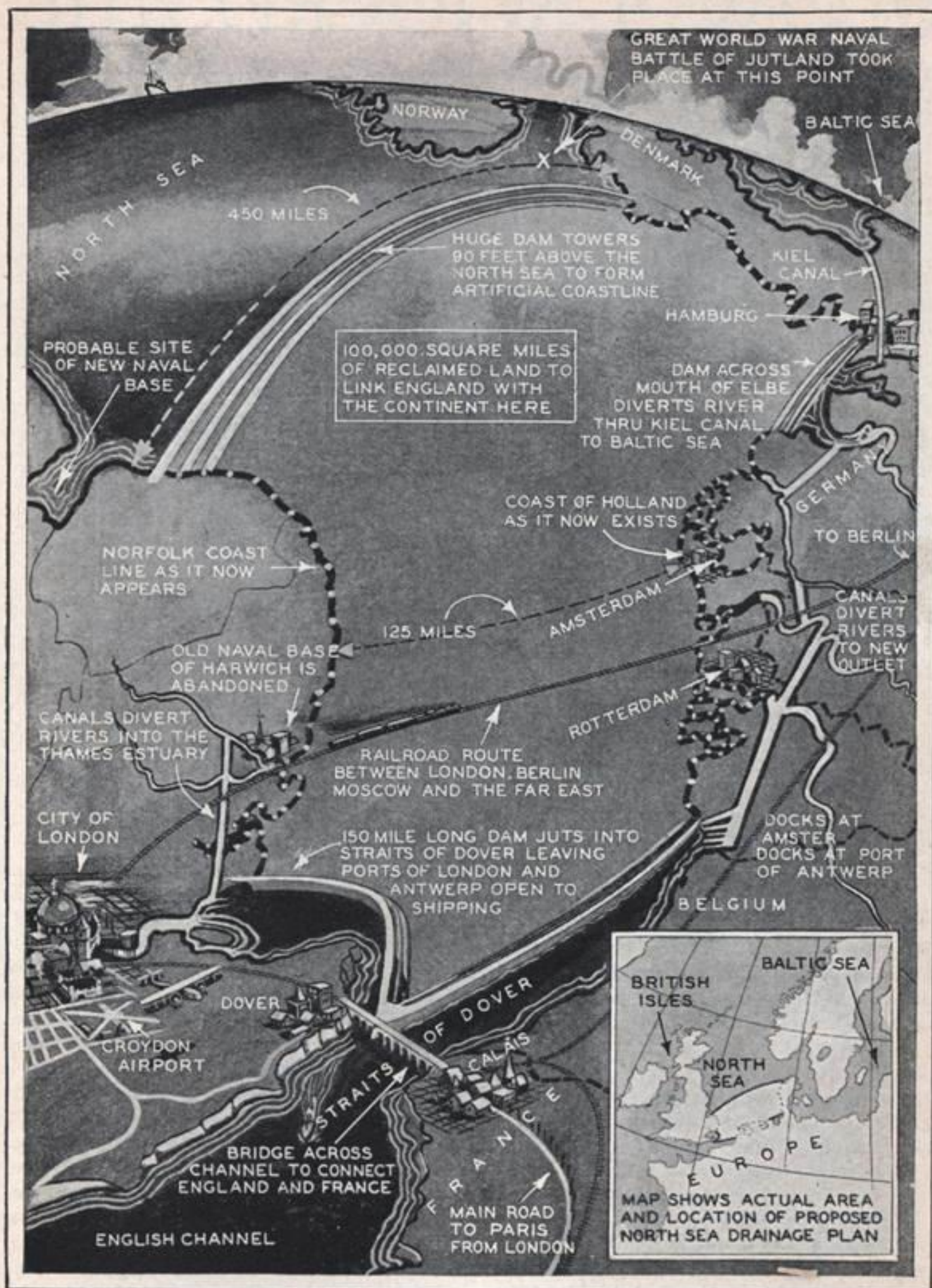
But to compensate for this "standing room mostly" which New Yorkers have come to consider unavoidable, there are four pairs of doors on each side of each car, permitting entrance or exit in eight files or lines. Also injury to passengers caught in closing doors is minimized by rubber

cushioned edges, and a device that makes the door stop, but not, as in older cars, rebound. The cars have no vestibules. They cost \$38,000 each.

Another wonder is the achievement in underpinning. The builders of the new subway had to prop up every sort of building, from two-story dwellings, to the newest steel skyscrapers. Yet all the time the occupants went placidly about their affairs, often ignorant that deep in the bowels of the earth beneath them, their buildings were being "put on stilts." The monument to Columbus at the entrance to Central Park is 75 feet high and weighs 724 tons, but it was easily picked up and reset atop a new pedestal resting upon the Eighth avenue subway.

Far more difficult was the crossing of three existing subways. These had to be underpinned securely, without interrupting trains, while beneath, men dug the tube.

North Sea Drainage Project to Increase Area of Europe



If the extensive schemes for the drainage of North Sea are carried out according to the plan illustrated above, which was conceived by a group of eminent English scientists, 100,000 square miles will be added to the overcrowded continents of Europe. The reclaimed land will be walled in with enormous dykes, similar to the Netherland dykes, to protect it from the sea, and the various rivers flowing into the North Sea will have their courses diverted to different outlets by means of canals.

New Weapons for the



COILED WIRE DISABLES TANKS.



Present weapons of Uncle Sam's soldiers are shown in this photograph, while at the left new methods of attack and defense are pictured.

by JAY EARLE MILLER

The last war saw the development of tanks, flame throwers, poison gases and airplanes as war weapons—what will the next war bring forth? Little-known facts about the latest death-dealing weapons and the defenses developed to draw their fangs are set forth by Mr. Miller in this absorbing and authoritative article.

A GERMAN patrol of Uhlans, the sunlight glinting on their polished helmets and the tips of their long lances, rode out of the woods above the Marne and down toward a small copse where a scouting detachment of Algerian cavalry, with drawn sabres, laid in wait for them.

The time is mid-August, 1914, just seventeen years ago, and the description is from a recently published volume of war memoirs by a French cavalry officer. Imagine the scene—lances against sabres. Here's another war-volume, "Fighting Fury", the autobiography of Major James McCudden, V. C., the famous "Jimmy" McCudden of the British Royal Air Force, who shot down fifty-seven German machines before he lost his life in

Next WAR

an accident. Just seventeen years ago today (August 22, 1914) he, with the British air force in France, saw his first German machine. The ground crew turned out to take pot shots at it with rifles while six English planes took off, armed with home-made hand grenades, in an effort to bomb it down.

There was no such thing at that time as an aerial machine gun. There was no interrupter gear to permit a gun to fire through the propeller, and when, two months later, a pair of army rifles was first mounted on an airplane they stuck out at angles of 45 degrees on either side of the fuselage, in order to miss the prop.

When people start talking about the next war it is hard to remember just how unprepared the world was when the last one started, and how much of the marvelous equipment in use toward

Science Increases Deadliness of New War Weapons

THE mere listing of some of the military inventions on which scientists are now working, or which have already been perfected, is sufficient to give a graphic picture of the deadliness of future wars. Some of the most amazing lines of research are listed below:

An electric rhythmic wave said to be capable of breaking down the molecular stability of gunpowder, and so exploding distant munitions depots.

A gas which will stop combustion when sucked into gasoline engines, and so prevent tank or airplane motors from functioning.

Rockets carrying explosives, directed on their course by radio from ground or airplane, may make heavy artillery out of date.

Virulent germs, placed on the tips of bullets, survive the heat of the bullet's discharge and make certain that the slightest wound inflicted will infect the victim with disease.

A German scientist has succeeded in doubling the speed of a bullet, thus making it possible for an ordinary rifle shot to penetrate an armored tank.

the end was actually developed during the period of hostilities. Because the United States got into the scrap near the end, when airplanes, tanks, machine guns, bombs, aerial camera, trench mortars, gas equipment, gas masks, artillery and all the other paraphernalia of war had become more or less standardized, there is a widespread impression that unpreparedness is peculiarly an American fault and that all the other nations went into the fight well armed.

Much has been rumored about the strange new weapons being developed abroad, and "scare head" newspaper stories about planes and gases capable of wiping out an entire city, such as New York, have been frequent since the war. Another weapon of which much was said six or eight years ago was the so-called "death ray" capable of either killing

GERMS IN BULLETS INCREASE CASUALTIES.



"DEATH RAY" AND MYSTERIOUS NEW GAS STOP GASOLINE ENGINES FROM FUNCTIONING.



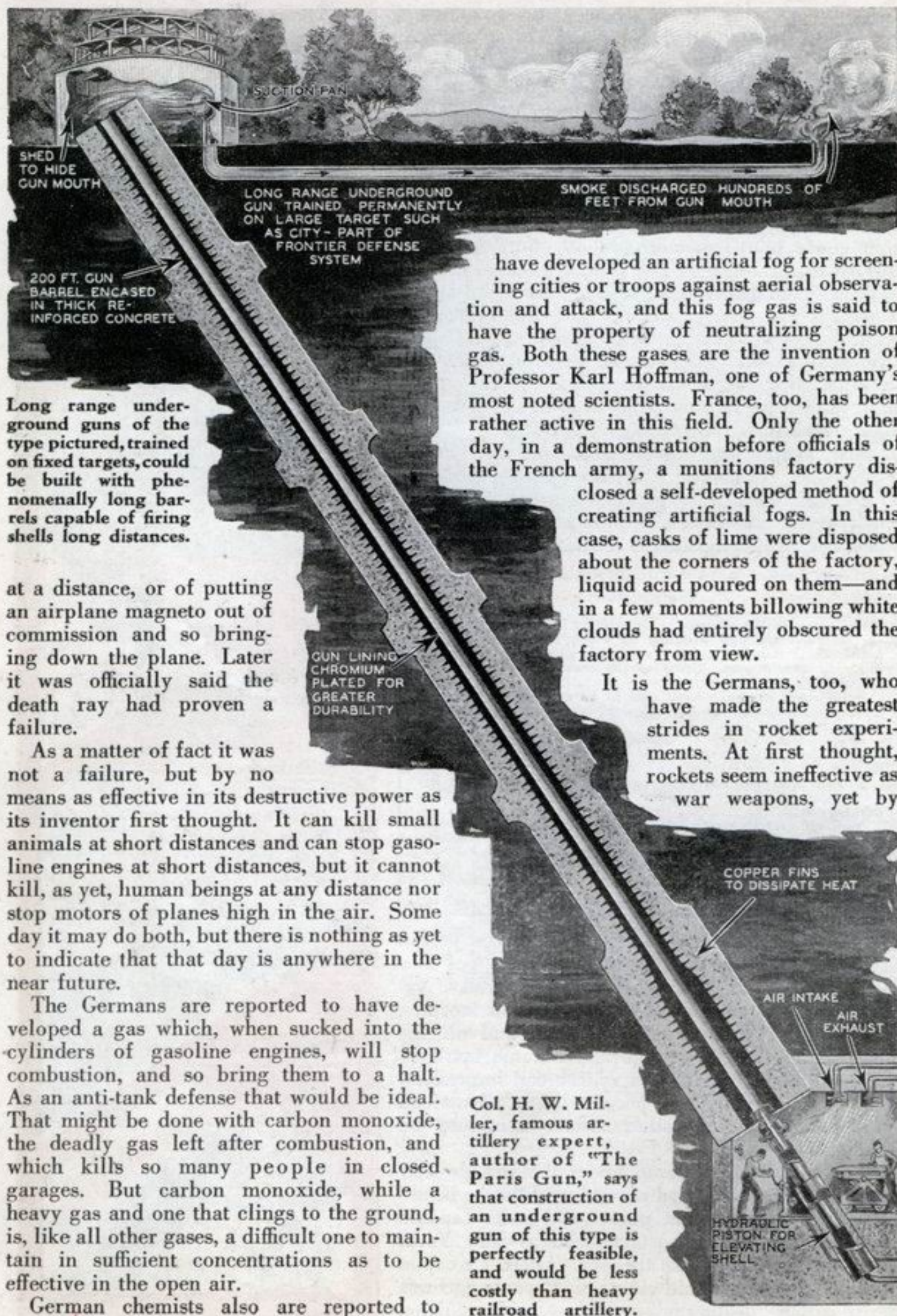
ARTIFICIAL FOG HIDES CITY-NEUTRALIZES POISON GAS.



RADIO CONTROLLED EXPLOSIVES MAY DISPLACE ARTILLERY.



200 Foot Gun, Directed at Fixed Target, Would Carry Long Distances



Long range underground guns of the type pictured, trained on fixed targets, could be built with phenomenally long barrels capable of firing shells long distances.

at a distance, or of putting an airplane magneto out of commission and so bringing down the plane. Later it was officially said the death ray had proven a failure.

As a matter of fact it was not a failure, but by no means as effective in its destructive power as its inventor first thought. It can kill small animals at short distances and can stop gasoline engines at short distances, but it cannot kill, as yet, human beings at any distance nor stop motors of planes high in the air. Some day it may do both, but there is nothing as yet to indicate that that day is anywhere in the near future.

The Germans are reported to have developed a gas which, when sucked into the cylinders of gasoline engines, will stop combustion, and so bring them to a halt. As an anti-tank defense that would be ideal. That might be done with carbon monoxide, the deadly gas left after combustion, and which kills so many people in closed garages. But carbon monoxide, while a heavy gas and one that clings to the ground, is, like all other gases, a difficult one to maintain in sufficient concentrations as to be effective in the open air.

German chemists also are reported to

have developed an artificial fog for screening cities or troops against aerial observation and attack, and this fog gas is said to have the property of neutralizing poison gas. Both these gases are the invention of Professor Karl Hoffman, one of Germany's most noted scientists. France, too, has been rather active in this field. Only the other day, in a demonstration before officials of the French army, a munitions factory disclosed a self-developed method of creating artificial fogs. In this case, casks of lime were disposed about the corners of the factory, liquid acid poured on them—and in a few moments billowing white clouds had entirely obscured the factory from view.

It is the Germans, too, who have made the greatest strides in rocket experiments. At first thought, rockets seem ineffective as war weapons, yet by

Col. H. W. Miller, famous artillery expert, author of "The Paris Gun," says that construction of an underground gun of this type is perfectly feasible, and would be less costly than heavy railroad artillery.

Long Barrel of Gun Would Reduce High Pressures, Lessen Wear

filling them with explosives and directing them at definite targets, they can be largely made to supplant cumbersome, heavy artillery. This possibility is by no means fantastic. Already a German experimenter has succeeded in firing a rocket with such accuracy that it landed precisely where he predicted it would. Radio control of rockets, either from the ground or from airplanes, would make them horribly effective, since they could be turned around in mid-air or their courses shifted at the will of the operator.

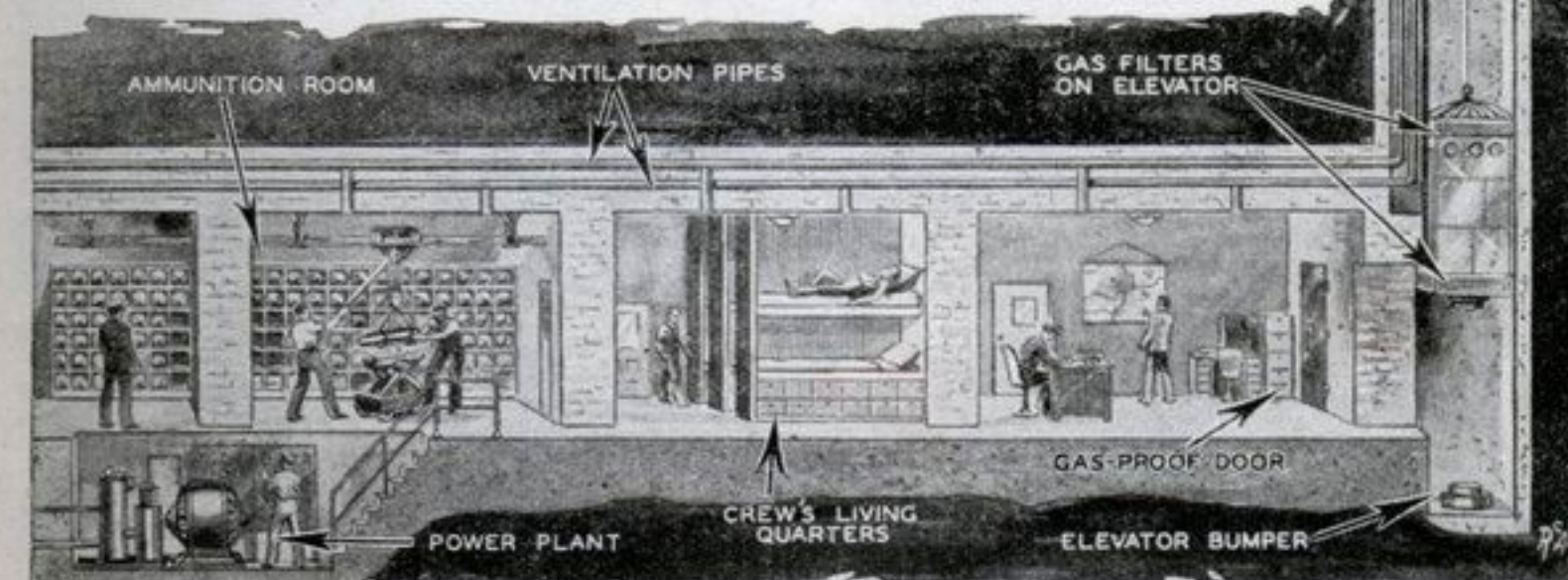
Recent experiments have shown that the heat caused by firing a rifle bullet is not sufficient to destroy disease germs clinging to the pellet. The simple process of dipping bullets into a culture of deadly germs, therefore, may make certain that all victims of such bullets become hospital casualties. The more wounded men who can be put out of action, the more hospitals that can be filled, taxing the enemy's resources to care for its stricken soldiers, the better from a military point of view. A soldier killed is out of action, but a soldier wounded is not only out of action—he's a positive liability. The advantages of this type of germ warfare, therefore, are obvious.

Other German inventions about which rumors have been heard are an armor piercing explosive bullet capable of penetrating any tank yet built, and a submarine torpedo fifty per cent faster than the Whitehead torpedo, and with the peculiar property of leaving no visible wake. Still another invention, a relative of the much touted "death ray", is an electric rhythmic wave or ray said to be capable of breaking down the molecular stability of gun powder and so exploding distant munitions depots.



While much was said after the war about returning to the provisions of the old Hague convention and so abolishing poison gas once more, no means has been found to enforce any such an edict. Faced with the fact that in the next war one of the contestants may use gas, just as the Germans did in 1915, all nations are maintaining their chemical warfare services and experimenting both with new gases and with new means of defense. The American chemical warfare service at Edgebrook Arsenal is doing considerable secret development work. Defenders of chemical warfare point out that of all the weapons used in France it proved the most humane.

"Even with the crude means of protection available in the World war, chemical agents cause



Defense Methods Keep Pace With New Destructive Weapons of War

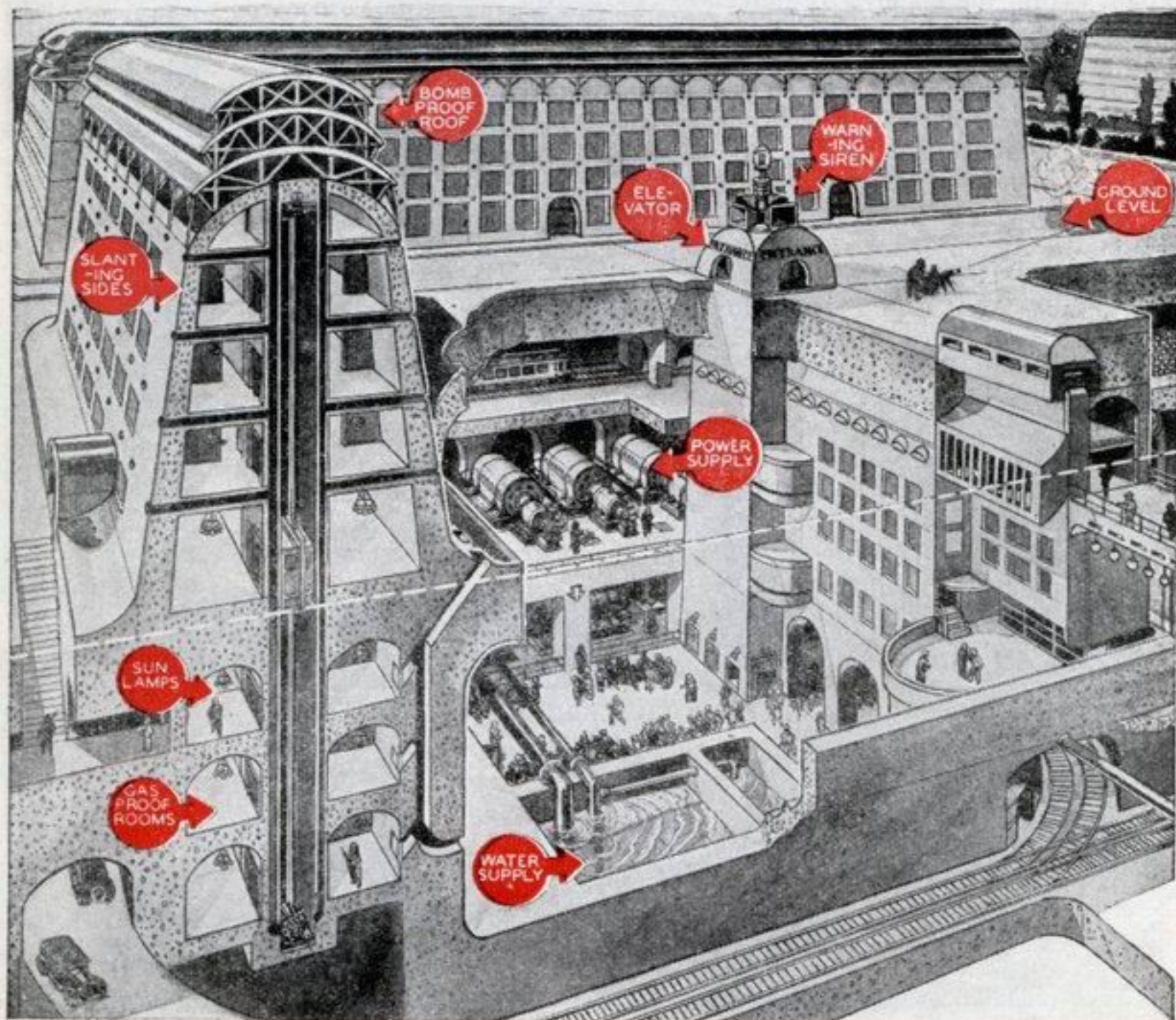
only one-twelfth as many deaths in proportion to the number of casualties produced by them, as was the case with other weapons," Major General Gilchrist said recently. In other words, twelve times as many gas wounded recovered as did those wounded by bullets, shells and bombs. Also, it is claimed, gas cases who recovered showed no bad after effects, while the hospitals are filled with those crippled by other weapons.

Gas experts laugh at the idea of dropping gas shells on large cities to wipe out the civilian population. Buildings offer too much defense against gas, the gas shells or bombs are too valuable in attacking troop concentrations, and high explosive bombs capable of destroying buildings would cause more damage and more panic in the cities, they claim.

Yet so widespread is the fear of gas and air attack that Soviet Russia has laid plans

for the construction of a series of underground cities near large centers of population, such as Moscow and Leningrad, where the people can retire in absolute safety in case of attack. As illustrated elsewhere in this article, such cities are subterranean fortresses with concrete roofs so thick that the most powerful air bombs can not penetrate them. Gas-proof chambers with filtering and ventilating attachments enable people to live in comfort and security even when clouds of deadly gases are billowing about a few feet over their heads.

Considerable secrecy surrounds the underground forts with which France is lining the German border. An immense sum is being spent on these underground, cement fortifications, with connecting tunnels and rooms capable of housing an entire army. Heavy artillery is being permanently mounted in the underground forts, and there have been rumors that fixed long range guns,



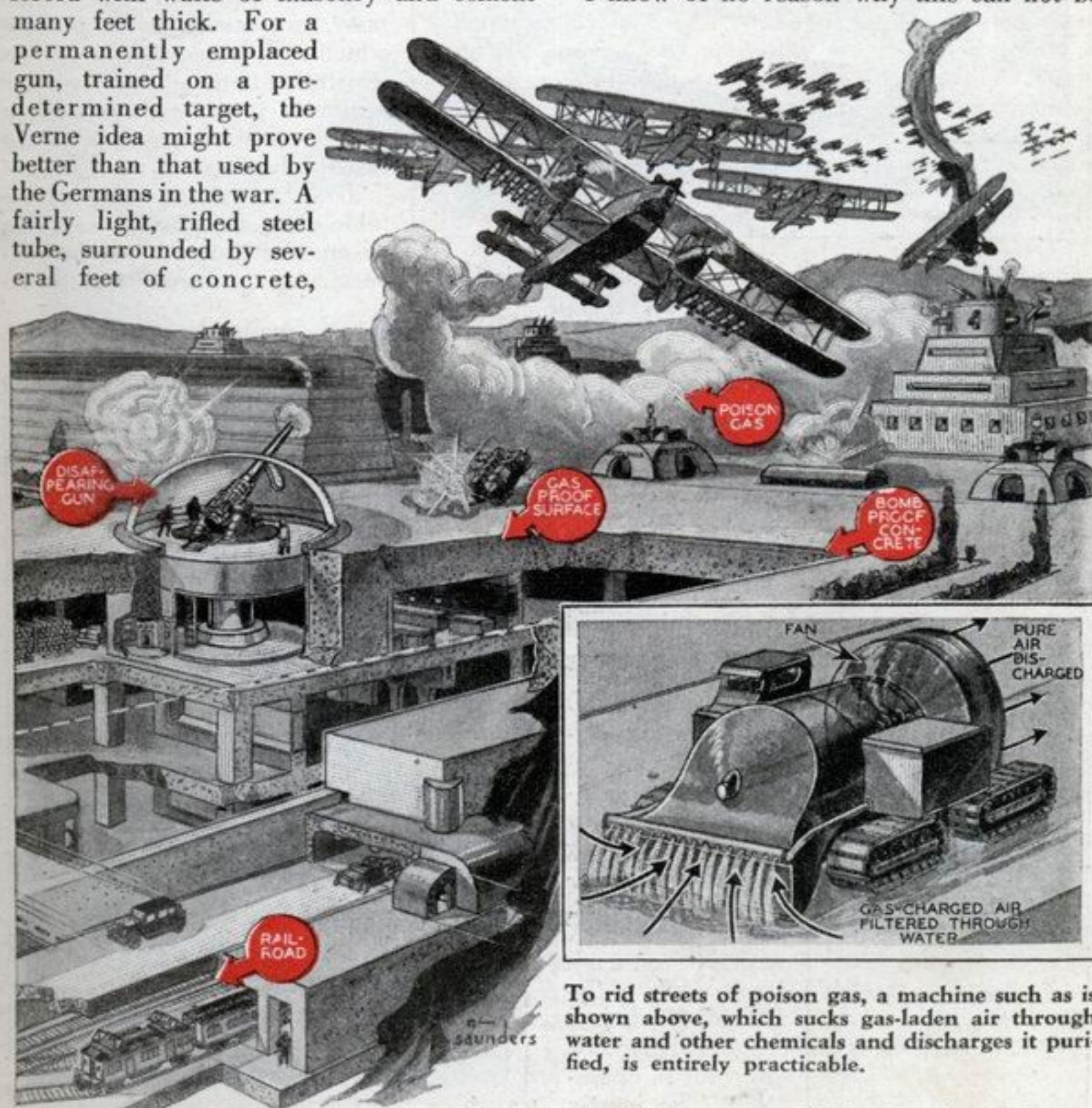
Buried City With Concrete Roof Would Be Immune to Gas, Air Attack

adapted from the plan of the German guns which shelled Paris, are being installed, trained on towns, railroad junctions and important cross-roads fifty miles or more behind the German frontier.

If the reports are true Jules Verne's famous *Columbiad*, which fired the shell to the moon in his well-known story, has found a rival. The *Columbiad*, as Verne described it, was 900 feet long, buried upright in the earth, the barrel being reinforced with walls of masonry and cement many feet thick. For a permanently emplaced gun, trained on a pre-determined target, the Verne idea might prove better than that used by the Germans in the war. A fairly light, rifled steel tube, surrounded by several feet of concrete,

mounted at an angle of fifty degrees, in a shaft extending down into the earth, would be cheaper and easier to build than one of the German guns. The latter were limited to 120 feet in length because they had to be moved by rail. A permanently emplaced gun could be 200 feet or more long, thereby reducing the high pressure, and the wear and tear on the gun.

The question of the feasibility of such a weapon was submitted to Col. H. W. Miller. "I know of no reason why this can not be



Means of defense keep pace with new offensive weapons of warfare, as demonstrated by this underground city which Soviet Russia plans to construct to defend its people against air bomb and poison gas attacks. Such city would be immune from bombing planes, thanks to thick layers of reinforced concrete.

To rid streets of poison gas, a machine such as is shown above, which sucks gas-laden air through water and other chemicals and discharges it purified, is entirely practicable.

done," he writes. "The fact that the gun would be held rigid in the concrete at the time of firing would work no hardship on the gun itself. We use recoil only because we want to reduce the instantaneous loads

(Continued on page 180)

Where TELEVISION

by DAVID SARNOFF

President, Radio Corporation of America

What progress is being made in television? How far has it advanced today? What new developments lie in the immediate future? These pressing questions, about which the vast public waiting for television is wondering, are answered in this unusual article by Mr. Sarnoff, whose eminence in the field enables him to speak with unquestioned authority.

IMPORTANT strides are being made with television. In our development work now proceeding at Camden, N. J., we are seeking to perfect television to a point where it is capable of rendering real service before offering it to the public.

While the public was willing, and even eager, to experiment with radio in the early stages of broadcast development, it seems to us that it will desire a comparatively more advanced television receiver than the early crystal radios.

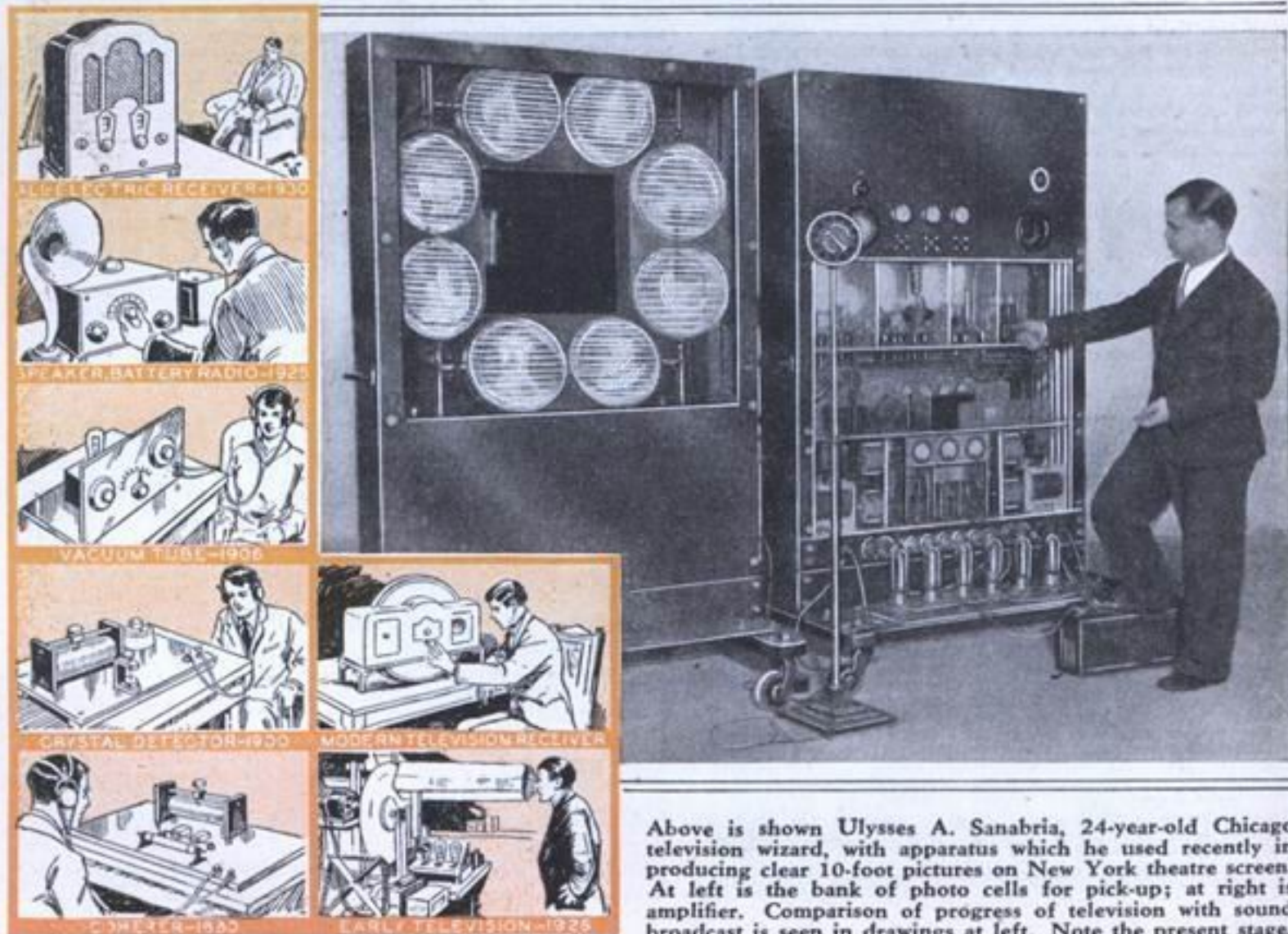
There was no precedent for the taking of sound and music out of space, but the public has been educated by the motion picture industry to expect picture transmission of a high quality, and it is doubt-

ful whether interest can be sustained by inferior television images.

The progress we have made so far has given us the belief that ultimately a great service of television can and will be made available. I do not believe that television will supersede sound broadcasting by radio. It will be a correlated industry.

The present status of television might be likened to the condition of radio in the immediate pre-broadcasting era, when amateurs were beginning to hear faint sounds through the air.

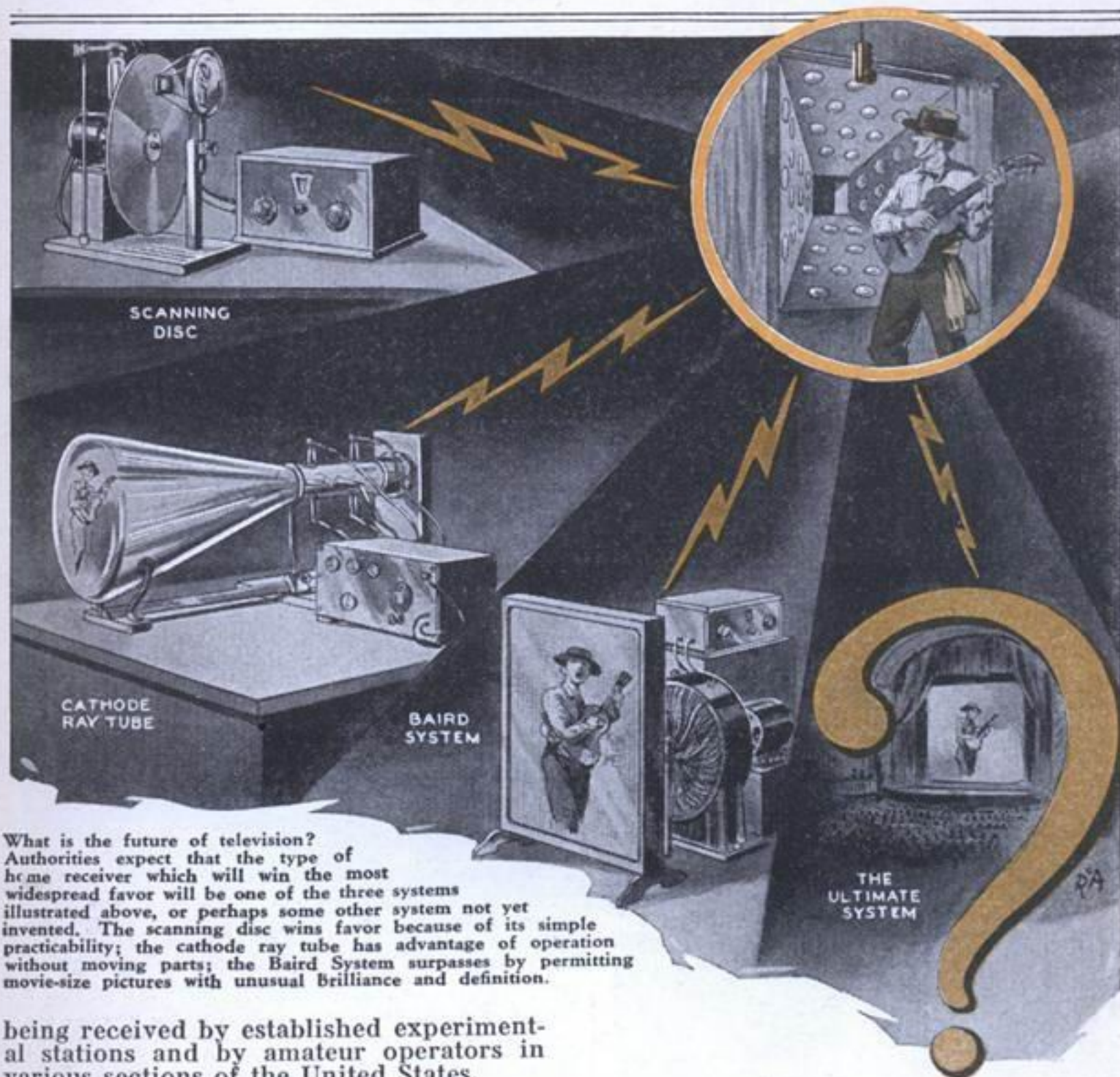
Voices and music were passing through space in those early days of radio; comparably, there are actually some images passing through the air today. They are



Above is shown Ulysses A. Sanabria, 24-year-old Chicago television wizard, with apparatus which he used recently in producing clear 10-foot pictures on New York theatre screen. At left is the bank of photo cells for pick-up; at right is amplifier. Comparison of progress of television with sound broadcast is seen in drawings at left. Note the present stage.

Stands Today

*An authority surveys
the present and
looks into the future*



What is the future of television? Authorities expect that the type of home receiver which will win the most widespread favor will be one of the three systems illustrated above, or perhaps some other system not yet invented. The scanning disc wins favor because of its simple practicability; the cathode ray tube has advantage of operation without moving parts; the Baird System surpasses by permitting movie-size pictures with unusual brilliance and definition.

being received by established experimental stations and by amateur operators in various sections of the United States.

The next stage should find television comparable to the ear-phone stage of radio. Then, television should attain the same degree of development as did radio sound broadcasting in the early period of the crystal set.

This does not mean that the actual physical structure of the first television receiver will be similar in any way to the crystal receiver.

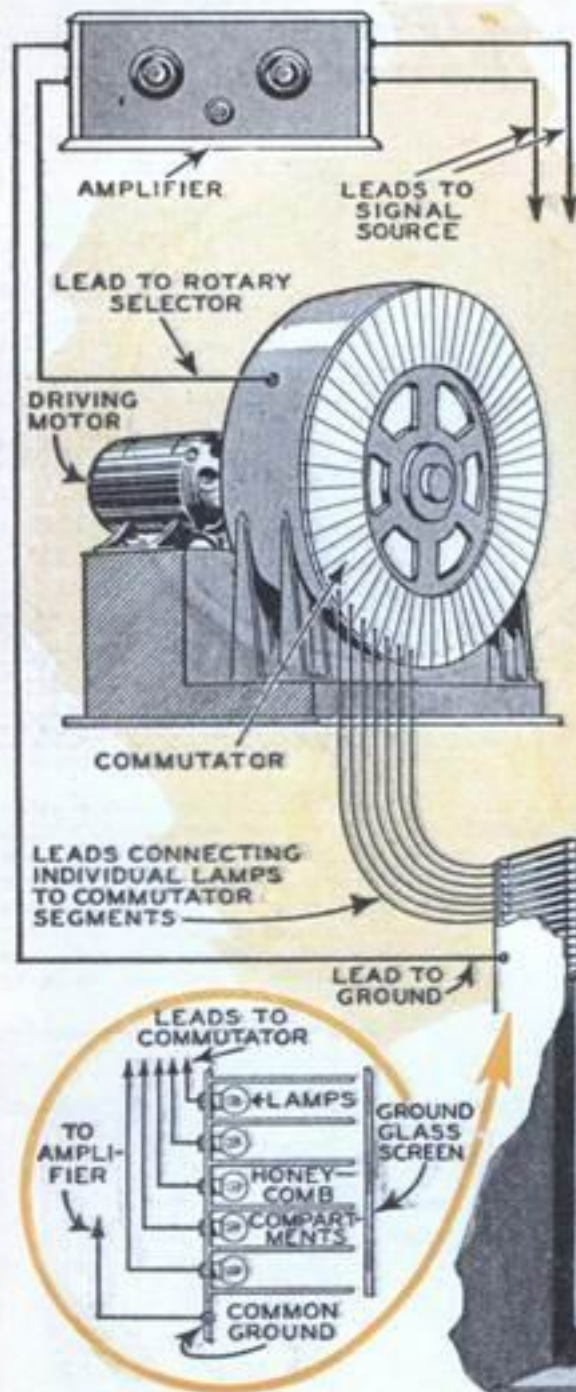
Before television reaches the practical stage of service it is necessary that several experimental stations for the transmission of sight by radio be established. Through the operation of these experimental stations, we expect to obtain exact information and practical field experience which are required before definite plans can be developed for a television service of nationwide scope.

The effect of television upon the present established radio industry will be beneficial. There will be no interference between the broadcasting of sound and of sight. These services will supplement each other and complete the impression upon the human mind by reaching it through both the eye and the ear.

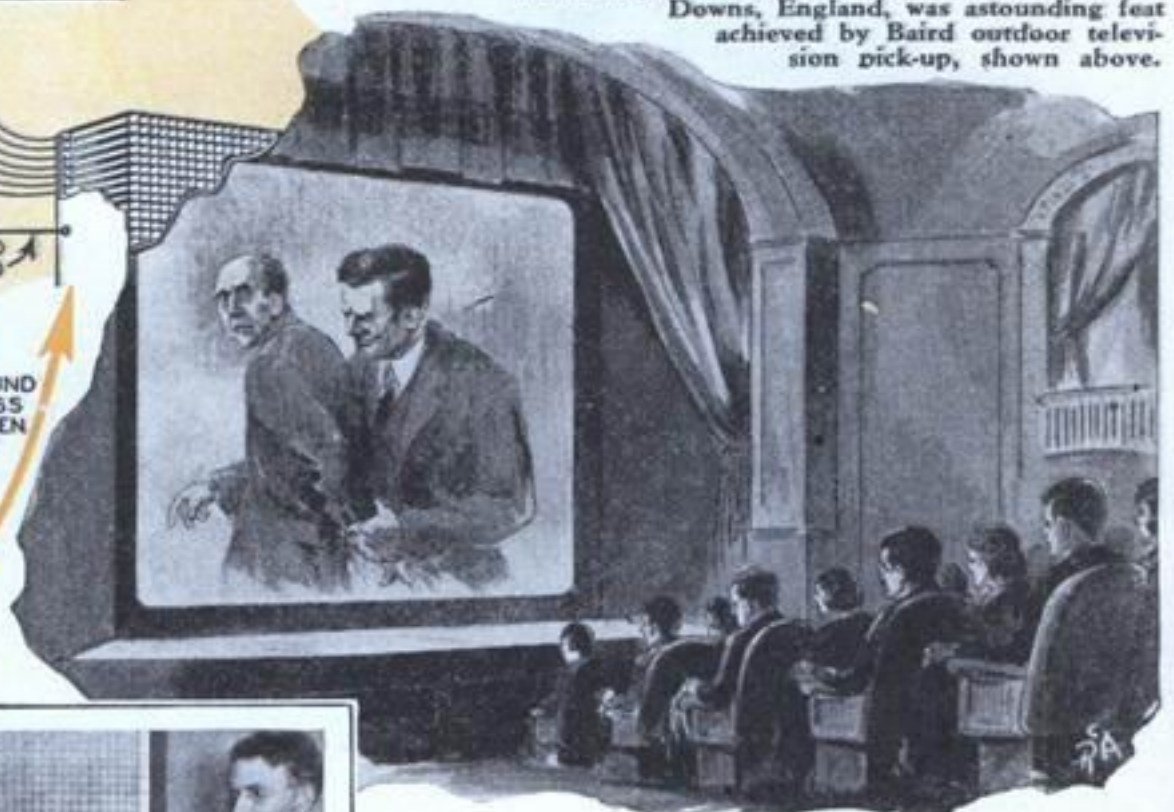
Television broadcasting stations will operate on wave lengths different from those now used for the broadcasting of sound. An entirely different receiver will be necessary. In the practical sense of the term, television must develop to the stage where broadcasting stations will be able to broadcast regularly visual objects in the studio, or scenes occurring in other places through remote control.

Reception devices must be developed

Baird System May Bring Theatre Television With Clear, Bright Images



Televising a horse race at the last Derby at Epsom Downs, England, was astounding feat achieved by Baird outdoor television pick-up, shown above.



Here Mr. Baird is demonstrating how image appears on the ground glass screen, built up in "square-effect" by lamps set in honeycomb-like compartments in the rear.

that will make these objects and scenes discernible in millions of homes.

Devices must be built upon a principle

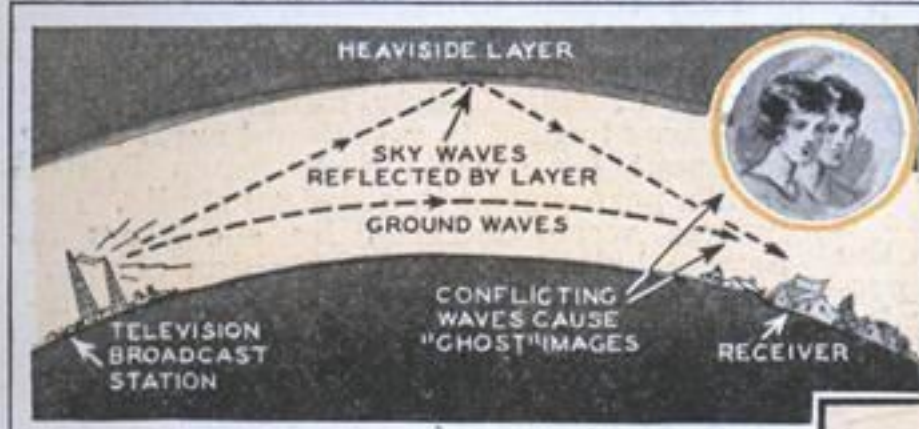
Chief advantage of the Baird system is that it makes possible television in the theatre, with images having unusual brilliancy with fair definition. The image is built up with small lamps in the compartments, current to the lamps being delivered from segments contacted by rotary selector connected to receiving amplifier, as illustrated in drawings.

that will eliminate rotary scanning discs, delicate hand controls and movable parts. Research must make possible the utilization of wave lengths for sight transmission that will not interfere with the use of the already over-crowded channels in space.

The potential audience of television in its ultimate development may reasonably be expected to be limited only by the population of the earth itself.

This vast increase in the entertainment audience has been made possible by the introduction of modern science into the older arts. And now television will come to open new channels, to provide new opportunities for art and the artist and to create new services for the audiences of all the world. Potentially speaking, tele-

Television Programs Sent on 4 Meter Waves to Prevent "Ghost" Images



To eliminate "ghost" images and permit greater number of picture elements, resulting in clearer images, engineers are building television transmitter atop Empire State Building, in New York, which operates on 4 meter wavelength. Waves are radiated directly to receivers, with no intervening obstacles, and serving audience of more than ten millions.

Television images broadcast on usual wavelengths (150 meters) sometimes result in "ghost" images at distant receivers. Sky waves reflected by heaviside layer lag behind ground waves and consequently arrive out of phase at receiver, causing double picture as illustrated in insert above.

vision can be utilized by 26,000,000 homes in this country alone.

The instantaneous projection through space of light images produced directly from objects in the studio or the scene brought to the studio by remote control involves many problems.

Special types of distribution networks, new forms of stagecraft, and a development of studio equipment and technique will be required. With these must come a new and greater service of broadcasting, both of sight and sound. A new world of cultural and educational opportunities will be opened to the home.

But even more appealing to the individual is the hope that television may, at least in a measure, enable man to keep pace with his thoughts. The human being has been created with a mind that can encompass the whole world within the fraction of a second. Yet his physical senses lag woefully behind. With his feet he can walk only a limited distance. With his hands he can touch only what is within reach. His eyes can see at a limited range and his ears are useful at a short distance only.

When television has fulfilled its ultimate destiny, a man's sense of physical limitation will be swept away, and his boundaries of sight and hearing will be the limits of the earth itself.



Drawings above illustrate most outstanding difficulties still encountered in present day television reception. When receiving scanning disc motor is out of synchronism with transmitting motor, images shift from side to side, or get out of frame vertically or horizontally. Pictures with poor detail usually result from insufficient number of lines in the transmitter scanning disc. Static causes light streaks.

Water-Foils Support HYDROVANE Ship

FOR years builders of ocean liners have been refining the designs of their vessels until it seems that the ultimate speeds attainable by the conventional hulls have just about been reached.

Promise of ocean speeds approaching that of fast airplanes is held forth, however, by a modified hydroplane type of sea vessel designed by H. G. Allan of Glasgow, Scotland, and illustrated in the drawing below.

As shown, the unique craft is essentially a streamlined hull supported on steel hydrovanes. These hydrovanes, planes, or water wings, as they may be described, travel through the water, but virtually on the surface. Ordinary hydroplanes, which are designed to avoid wave-making resistance, attain remarkable speeds but are unseaworthy in rough water.

Mr. Allan's craft, according to tests with models conducted by him, not only

travels at top speed on smooth water, but is excellently adapted for skimming through heavy seas. The hydrovanes and the arms which connect them to the hull are thin and streamlined, enabling them to cut through the water in such a way as to eliminate rolling and pitching, even though waves may be 30 feet high.

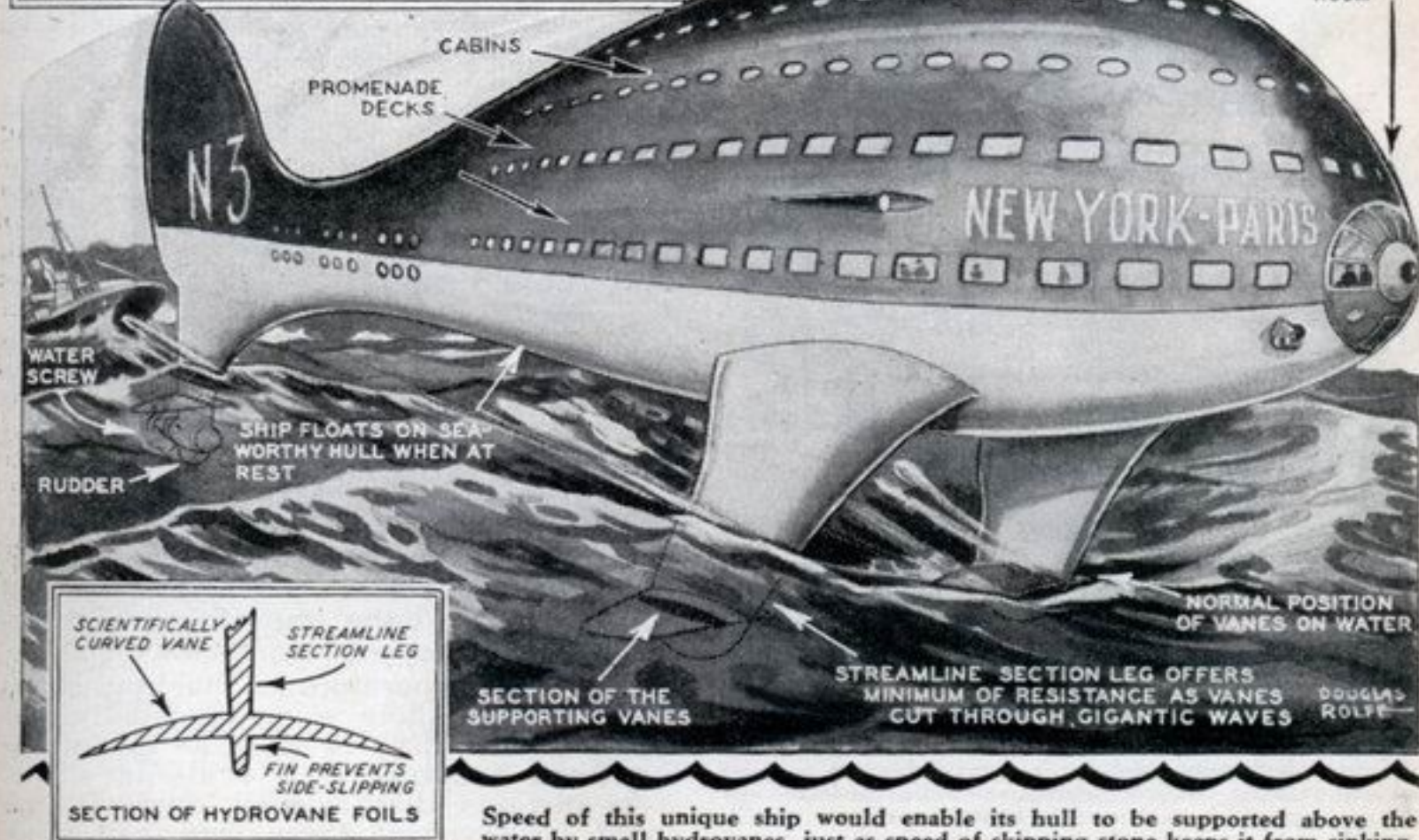
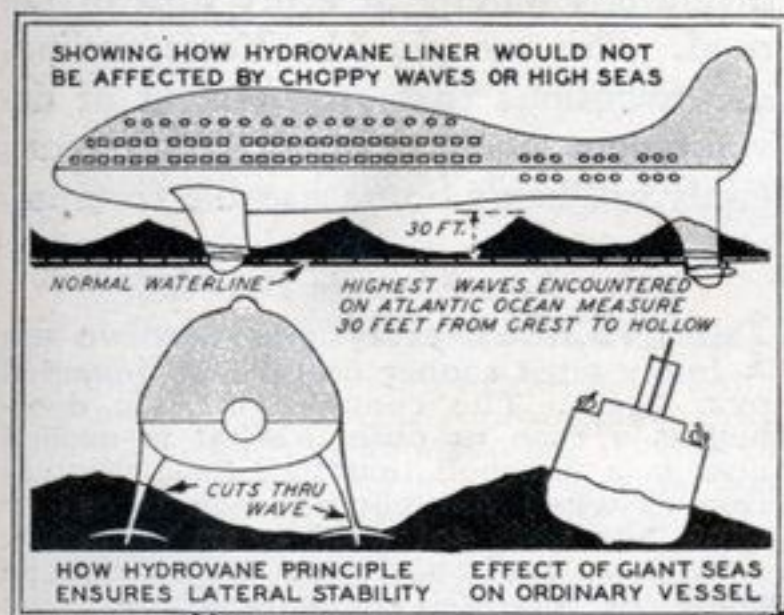
It may seem at first glance that the hydrovanes which support the ship are very small, but at high speeds they are adequate to support a heavy hull. The slower the ship travels, of course, the larger must be the supporting hydrovanes. The principle is the same as that which supports a stone skipping over the surface of the water—when forward speed slackens, the stone sinks.

Floats on Surface When at Rest

In like manner, when the hydrovane ship ceases to move forward, the vanes sink into the water until the hull is floating on the surface.

The drawing shows a water screw under the rear hydrovane as the propelling medium. An air screw could be used, but would be less practical owing to the fact that head winds would slacken its efficiency to an extent proportionate to the mile per hour speed of the breeze.

The idea of using hydrovanes for the purpose of lifting a craft above the water or reducing its draft is not new, but the theory and design of hydrovanes or water-foils has not been thoroughly understood in the past.



Speed of this unique ship would enable its hull to be supported above the water by small hydrovanes, just as speed of skipping stone keeps it from sinking.

"Balloon Cops" May Clear Traffic Jams

THE traffic tangles caused by major football games has become a problem of great importance to those cities that have the larger stadiums within their bounds. For hours before and after the games the police are compelled to work at top speed to restore the normal movement of traffic, being called upon at times to handle some fifty thousand additional cars.

At the various traffic conventions held about the country this problem has received much attention but it was only recently that a plausible solution to the matter was offered.

50,000 Cars Controlled by One Man

Police departments have realized right along that these great traffic loads, reaching peaks that were as high as thirty thousand cars above normal, made co-ordination practically impossible with existing methods. What was needed was a traffic dictator sitting in some exalted position and lord of all that he surveyed. The captive balloon system, it was found, would provide these accommodations, giving a single man the opportunity of seeing the traffic

jam as a whole and providing him at the same time with the necessary signal apparatus to direct the movement of vehicles on every street in the congested district.

In this way, motorists, even though well-meaning, would not be working to the disadvantage of each other, nor would they be defeating the very thing that they were trying to accomplish.

"Balloon Cop" Operates Stop-go Lights

In the scheme devised special traffic signals would be installed and these would be of a portable nature so that the signalling and telegraphic departments of the police could install them in a few hours. Carried up with the captive balloon would be a large cable containing the nerve centers of the entire system that would terminate in a master-control switchboard spread out before the great traffic god who by the mere manipulation of switches would rid the traffic-burdened city of its excess vehicles in one hour, instead of the customary two or three hours now required.

This dictator would operate switches but he would also have clasped to his chest a telephone that would put him in touch with motorcycle cops at strategic points. The motorcycle cops would be immediately dispatched to points having minor accidents so that the various arteries could be kept open.



In system recently proposed to solve traffic congestion problem around a stadium, a supreme traffic cop from station in car of captive balloon manipulates street stop-go signals over switchboard, and dispatches motorcycle police with phone.

Building Dreams of Steel



They said it couldn't be done—span the Bay and Golden Gate with bridges, but San Francisco did it. And threw in a great Exposition to boot. This story tells how the impossible is accomplished.

World's largest and most magnificent single span suspension bridge over the Golden Gate. It is the first bridge ever to be thrown across a major harbor entrance, and when completed in May, 1937, will form the key link in the proposed All-Pacific Coast Highway System.

THE intricate and wondrously knit glittering spans of the world's two greatest bridges across the Golden Gate and Oakland Bay, and a magic isle of Atlantis—dripping with all the miracles of an international exposition, is what San Francisco is preparing for your coming in 1938-39.

The site of the Exposition lies in the white-capped San Francisco-Oakland Bay area, midway between the two cities, on shoal land located just north of the adjoining Yerba Buena Island. And this year 385 acres of shoal will be filled in to provide the site for the Exposition. By the end of 1936, when the fill is completed, architectural plans for the buildings will also be finished, so that actual construction will begin with 1937.

A "natural" for an airport, you think. And you are right. When the Exposition closes, San Francisco will erect there the last word in up-to-the-minute flying terminals, all

within just a few minutes bridge ride to the downtown district, or to Oakland proper.

The unique position of this site—a deep-water island—makes it possible for the merchant and naval ships of every nation to drop anchors a stone's throw away. Or, for exhibition purposes, to berth at the site's piers.

The San Francisco-Oakland Bay Bridge is $8\frac{1}{2}$ miles long—figuring the east and west approaches. The bridge proper, including the island crossing, is 23,000 feet long—approximately $4\frac{1}{2}$ miles.

The western half of the bridge is in reality two complete suspension bridges anchored midway between San Francisco and Yerba Buena Island to a concrete anchorage rising 478 feet from the rock beneath the bay floor. Ship clearance of the bridge is from 200 to 218 feet above the surface of low water.

Fit companion to this giant span, is the Golden Gate Bridge now being built to serve San Francisco and the North Bay Redwood Empire. It will be the world's largest and most magnificent single span suspension bridge, and is the first bridge ever to be flung across a major harbor entrance. Its 746-foot towers support a 4,200-foot span. The famed Eiffel Tower of Paris exceeds the towers of the Golden Gate Bridge by a height of only

In San Francisco Bay

by
C. W. GEIGER



The San Francisco-Oakland Bay Bridge spans the largest navigable body of water yet bridged. No other bridge sweeps so high over the ships below. Over eight miles long, the west half of the bridge is in reality two suspension bridges.

239 feet. Or, to get nearer home for comparisons, the bridge towers are 191 feet taller than the Washington Monument. Thus, then are two mammoth bridges, where one alone might serve. But California always does things in a great big way.

The Oakland commuter today rides on 20-mile-an-hour trolleys to the ferry moles, then spends 20 more minutes ferrying to San Francisco, after which he climbs aboard another trolley to ride uptown to business. Or he comes in on the Sausalito Ferry from the North Bay Redwood Empire, losing even more valuable time.

But under special safety control from a point in Emeryville, the Oakland commuter will soon scoot in subway-type trains at 60 miles an hour to a central San Francisco terminal loop, close to his work, thereby cutting his hours of commutation travel more than half.

The San Francisco-Oakland Bay Bridge riggers are engaged in erecting the longest bridge arms ever attempted by cantilevering—literally pushing steel out into thin air.

The two arms (see illustration) are now a little more than 400 feet long, which means they are rapidly reaching the danger point.

If nothing goes wrong the connection will



Each cantilever arm of the bridge will have to stretch 700 feet over open water before arms connect.



South of Market Street as it will appear in 1938. The bridge comes into San Francisco at a height of 175 feet, and the unique ramps permit traffic to flow in every wanted direction, as shown in the illustration above.

You Won't Have to Wait at the Golden Gate

be made in a little over a month, but right now the bridge men have their fingers crossed.

On top of this comes another problem—that of stretching out thousands of tons of steel into space so that the “sag” due to gravity will be equalized. You and I think these great arms are being built parallel to the water, but we are wrong. They are tilted so that the outward ends of the bridge are about four feet higher than the level at the starting piers. In other words, the “sag” has been so calculated that the enormous weight of the free-floating steel bends it downward, and thus the two bridge sections will eventually join without a detectable difference in plane.

What could be more wonderful than to commemorate the completion of these two great bridges with an International Exposition?

For the Exposition will be international in scope. Its theme will be modern developments in transportation and communication as symbolized by the bridges, by the trans-oceanic air service and the progress of radio.



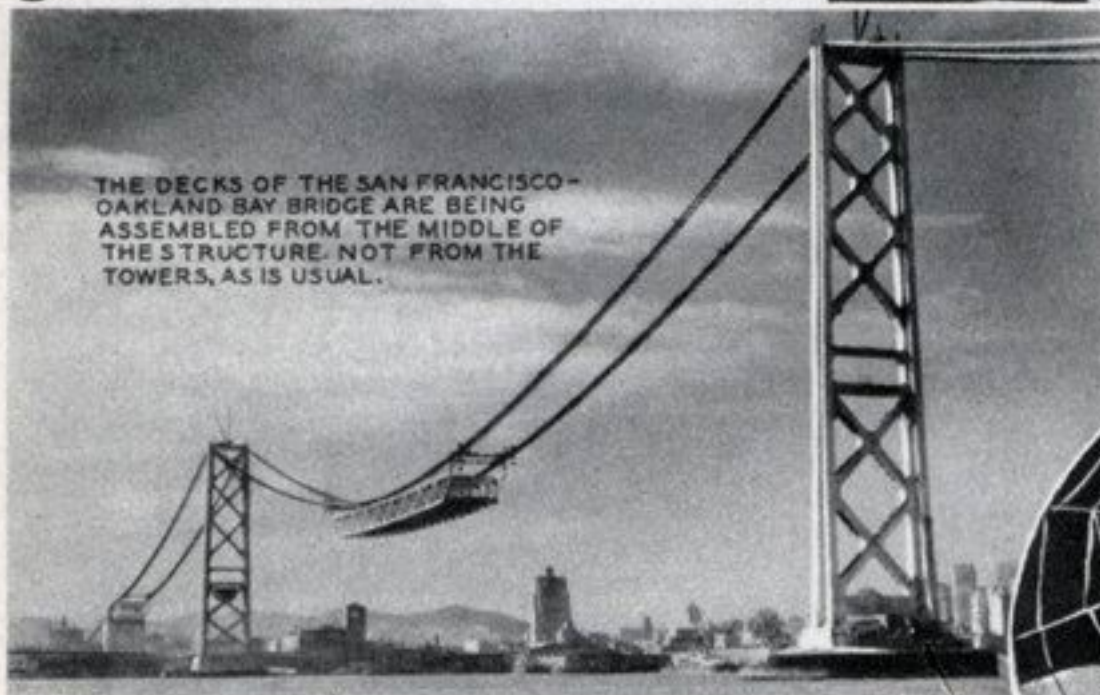
THE GOLDEN GATE BRIDGE AS CONTRASTED WITH THE WASHINGTON MONUMENT



COILING THE BRIDGE RIVETS INTO A SNAKE WOULD RESULT IN A BOA CONSTRUCTOR 36 MILES LONG.

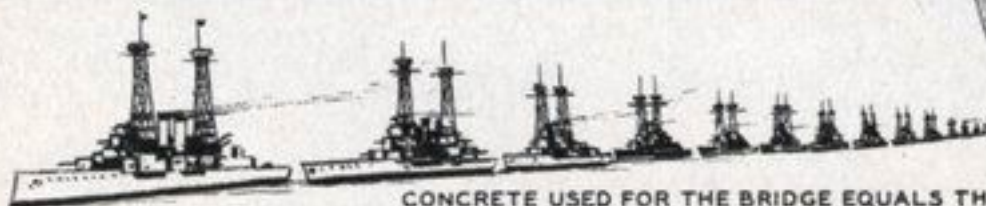


THE STEEL USED IN THIS BRIDGE WOULD LOAD A FREIGHT TRAIN 20 MILES LONG.

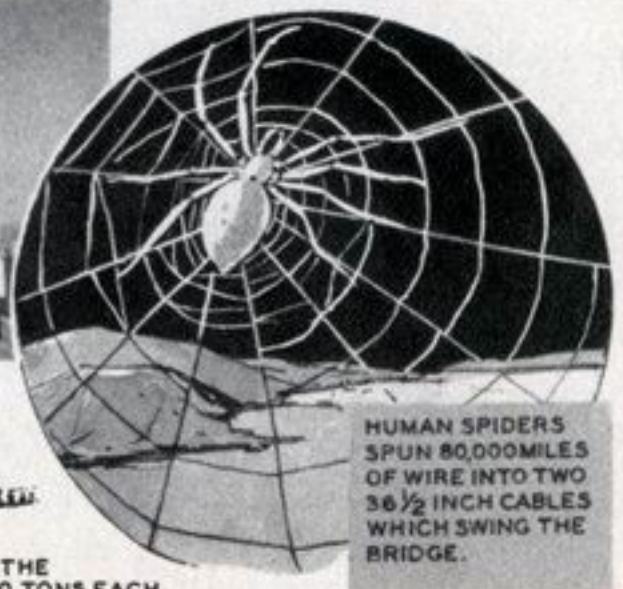


THE DECKS OF THE SAN FRANCISCO-OAKLAND BAY BRIDGE ARE BEING ASSEMBLED FROM THE MIDDLE OF THE STRUCTURE, NOT FROM THE TOWERS, AS IS USUAL.

Sixty years ago, a few impractical San Franciscans had an impossible dream. Some day, they said, bridges would span the waters of their beloved city. Today these men are gone, but their crack-brain ideas have crystalized into an actual fact.

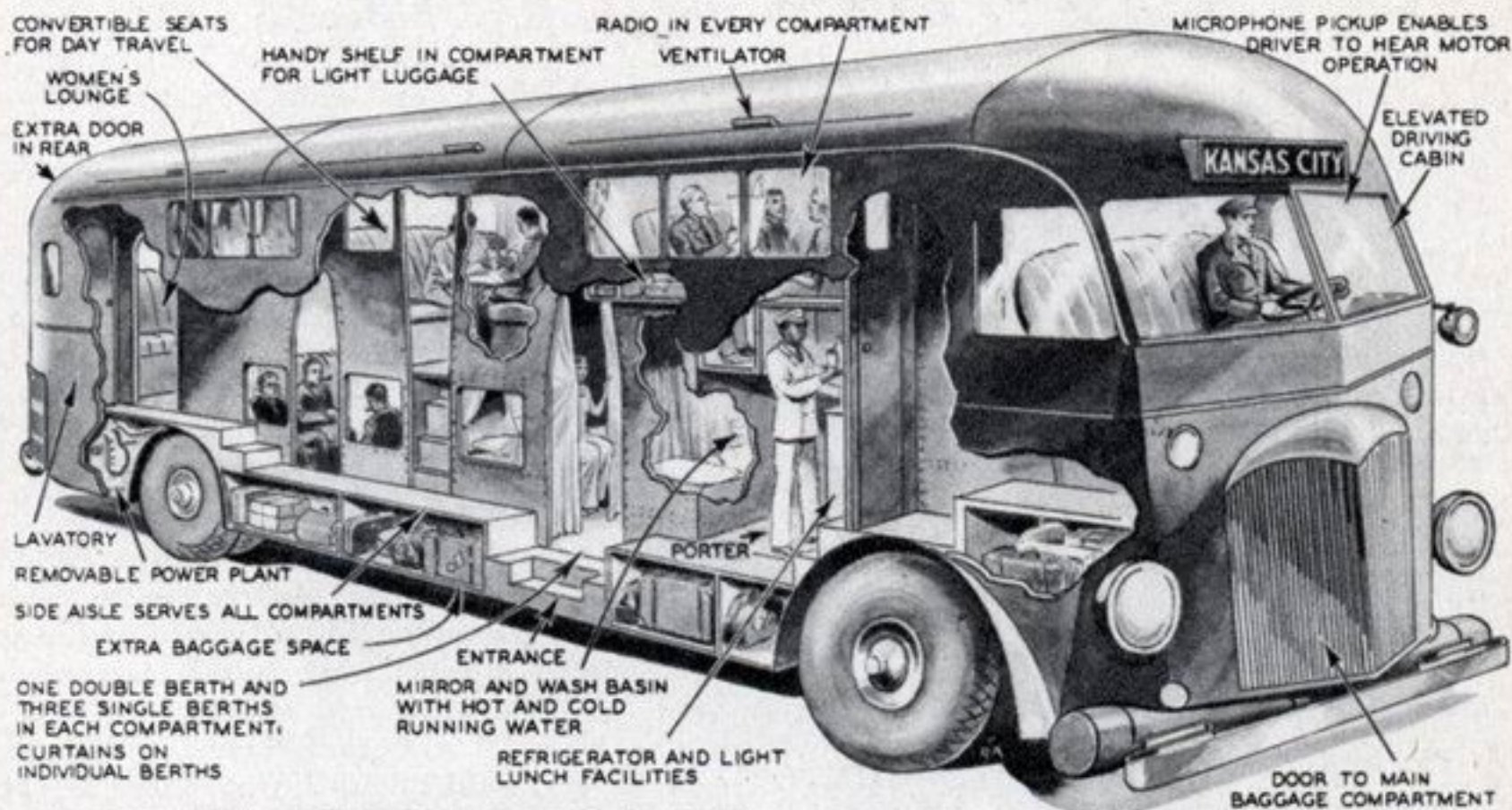


CONCRETE USED FOR THE BRIDGE EQUALS THE DISPLACEMENT OF 10 FIRST LINE BATTLESHIPS OF 33,000 TONS EACH.



HUMAN SPIDERS SPUN 80,000 MILES OF WIRE INTO TWO 36 1/2 INCH CABLES WHICH SWING THE BRIDGE.

Deluxe NIGHT BUS Has Private Berths



AMERICA'S first daily cross-country sleeper-bus, a luxury home on tires, recently ushered in "nite-coach" service between Los Angeles and Kansas City. Designed to make long-distance travel more enjoyable for the passenger, the new Greyhound bus boasts many features.

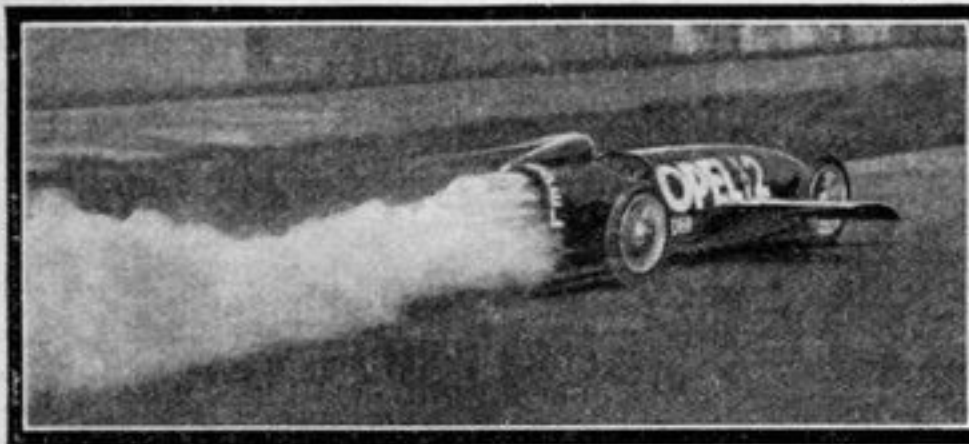
Berths for 25 persons are found in each of the fleet of coaches. There are five compartments equipped with radio, mirror, hot and cold running water and a portable table.

Entrance to the bus is made at the right

center, but unlike yesterday's vehicle, an aisle running the entire length of the coach is provided along one side. Each compartment contains a large double berth and three singles, convertible into cushion lounge seats for day travel. There is sufficient room to permit dressing while standing up.

The walls of the bus are insulated against radical weather changes while a special ventilation and heating system maintains constant temperature. To eliminate noises, the power plant is located at the rear and can be removed and replaced in twenty minutes. Behind the false radiator front are spacious quarters for storing luggage.

Daring Rocket Men to Invade



Experimenting with giant rockets, dauntless scientists are planning fresh invasions of the ether. Here is a complete story of their latest projects.

Success of the rocket-driven auto, left, paved the way for conquest of the ether.



Capable of both horizontal and vertical flight, this rocket snaps a picture and returns to the sender.



The late Herr Tilling, German rocket builder, explains novel features of his wing rocket.



Penetration of the stratosphere to a depth of fifteen miles is planned by the Cleveland Rocket Society, here shown conducting a successful test of a new rocket motor. The model motor consists only of a combustion chamber. A highly volatile gas combination is fed through two tubes in the nose. Oxygen is poured through one inlet and gasoline under 250 pounds pressure through the other.

THE rocket-shooters are going to pitch in again this coming summer. Undaunted by reverses and tragedies during the past year's experiments, the rocketeers are tackling their work with renewed vigor and ambition, plus improved apparatus and chemicals.

Ernst Loebell, famous German engineer and rocket designer, promises to bring the rocket engines to their greatest point of achievement next summer. He is now in this country and is an active worker in the Cleveland Rocket Society.

Loebell has been carrying on his preliminary experiments on the big Hanna estate in a suburb of Cleveland. In their operations the Cleveland group has been making use of the lessons taught by the experiments of Loebell's countryman, the late Reinhold Tilling, a noted radio engineer and rocket builder.

Prior to his death, Tilling had been experimenting with rockets and rocket planes for months. The success of a rocket which reached a height of 6,000 feet in 1931 spurred him on to the construction of a rocket with glider wings which unfolded when the fuel was exhausted and brought the projectile gently to earth. This feat was hailed as one of the first practical steps toward the development of mail and passenger carrying rockets.

The Tilling rockets were set in motion by telignition from a distance of 100 yards. They attained a speed of 700 miles an hour and landed five miles from the starting point, in accordance with calculations. Herr Tilling was working on a system designed to manipulate his rockets by radio control when he and a female assistant were killed in the explosion of a rocket which they were charging.

Such information as emanated from the secrecy surrounding Tilling's operations at Osnabrueck, Germany, has since been in the possession of the Cleveland Rocket

the STRATOSPHERE *by* ALFRED ALBELLI



An artist's conception of the man-carrying rocket of the future. Note autogyro vanes which float the rocket back to earth when power is spent, allowing it to settle gently on landing fins.

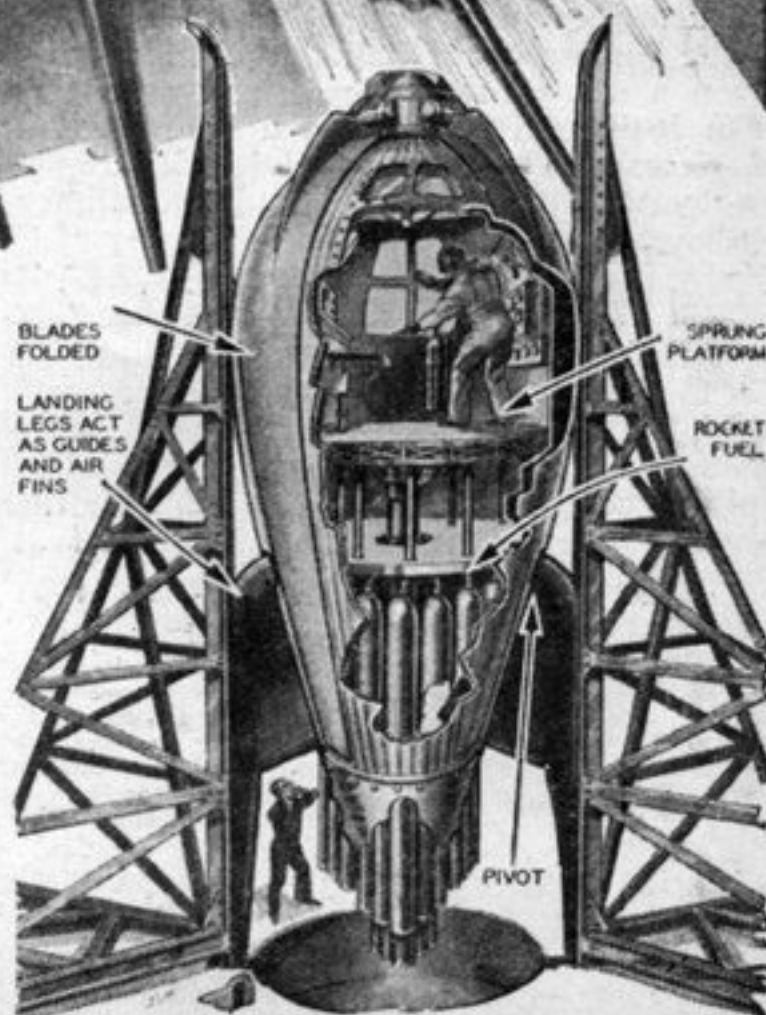
Society's guiding geniuses. They plan to adopt the Tilling heritage and carry his work to further perfection. †

Ernst Loebell and his assistant, Ted Hanna, have also investigated another secret German rocket—that of the famous Fischer brothers, details of which have also been closely guarded. The Fischers have achieved the biggest advance thus far in the field of passenger rocket flying.

The Fischers pursued their experiments on the island of Rugen in the Baltic Sea under the auspices of the German War Ministry. Otto Fischer, brother of Bruno, who designed the rocket, was shot up 32,000 feet, more than six miles, into the air in a 24-foot steel projectile.

At the peak of the rocket's trajectory, Otto released a parachute attached to the

(Continued on page 118)



Scientists Find TRACES of



This map shows how the world looked approximately 250,000,000 years ago, when North America, termed North Atlantis, stretched from California to the British Isles. South Atlantis, the existence of which is brought to light through recently discovered sand writings in Venezuela, was equally large.



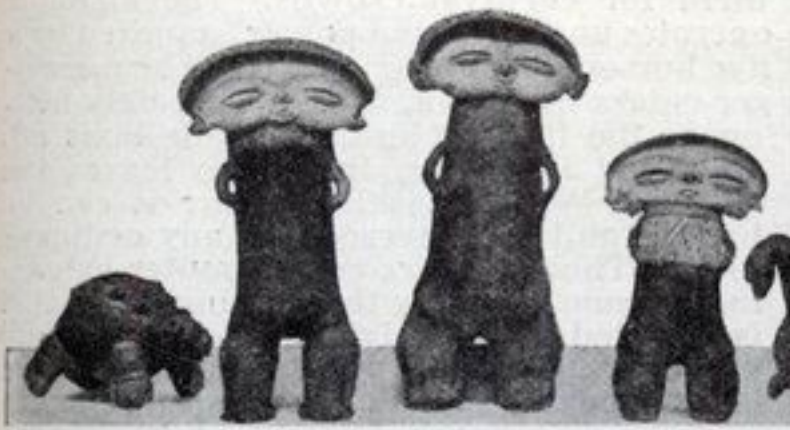
Dr. Rafael Requena, left, Venezuela government official and archaeologist, has brought to light what he claims are sand writings of a prehistoric day. With him is Dr. Wendell C. Bennett, curator of South American Archaeology of the American Museum of Natural History.

DOWN through the ages, man has hung to the words of Plato. For Plato told of a great continent, Atlantis by name, which slipped under the waters of the sea, carrying with it an entire civilization.

Recent discoveries point to the fact that approximately 250,000,000 years ago, South America, Africa, India, Australia and a great portion of the Antarctic region were a single continent. Similar discoveries reveal the existence, until about the same period, of a North Atlantis, a sort of supercontinent, which ran from the present western shores of North America to the British Isles, and possibly connected, by a few small peninsulas, with Europe.

Mysterious prehistoric rock writing, recently found in Venezuela by Dr. Rafael Requena, is believed to be the work of people who lived on the lost South Atlantis. In addition to the writings, Dr. Requena has found many relics of a by-gone culture. They include small statues of humans, with males and females easily distinguished and replicas of animals, many of which resemble the strange dinosaurs which have been dug up in other portions of the world.

Two LOST CONTINENTS



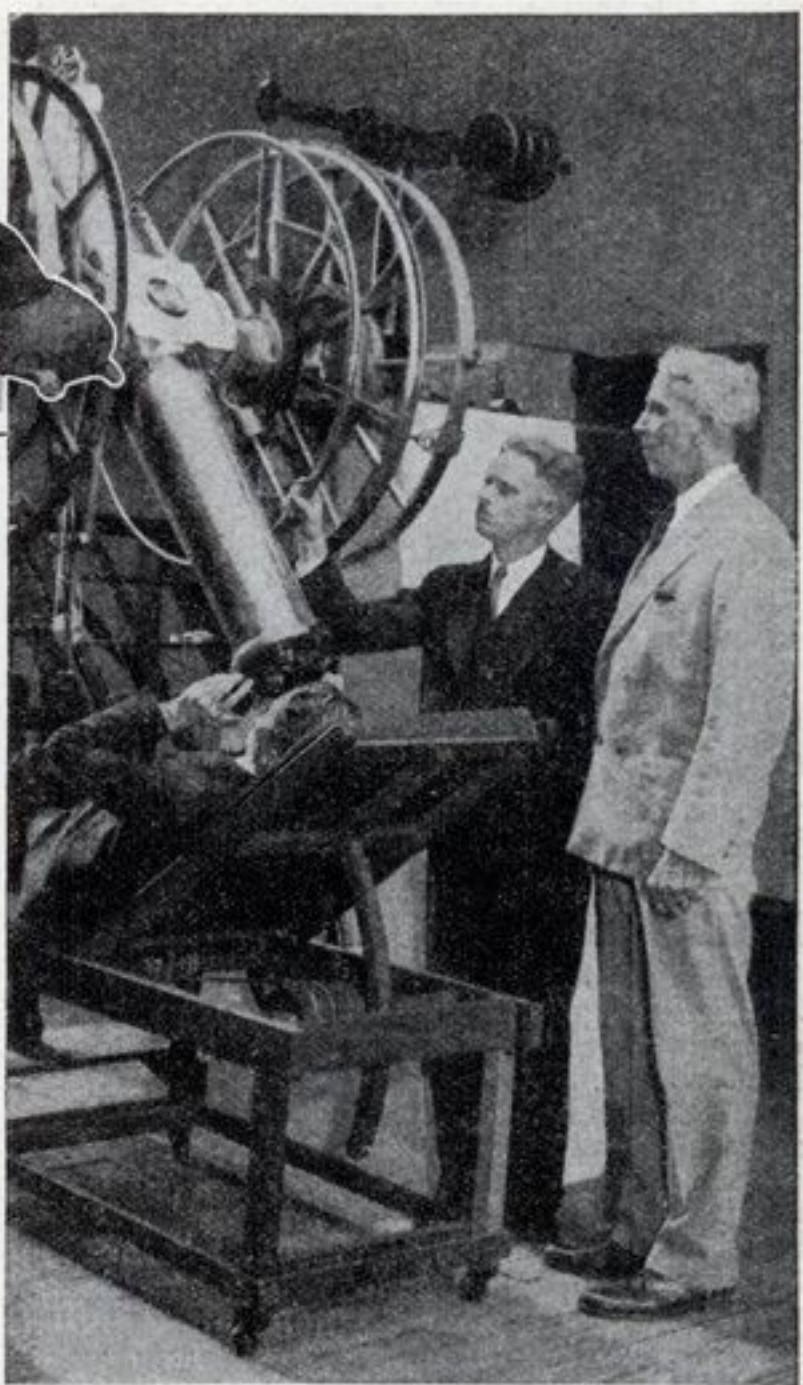
These strange, doll-like statues have been found in Venezuela. It is believed that they were made by the people who once inhabited South Atlantis. Note the replicas of animals and how the one on the extreme right resembles a dinosaur.

If the world were once generally divided into only two great continents, North and South Atlantis, is it possible, or even probable, that the continents will again change? Scientists do not care to answer that question until they have definite evidence upon which to base their conclusions.

And so the work of gathering evidence on drifting continents proceeds. It is a slow task, requiring years and years, because all calculations must be on a most minute and intricate scale.

Observers at 95 points over the world, including five in the United States and two in Canada, have started the work. They train their telescopes on certain stars and make an exact reading. Then, years from now, this process will be repeated and by comparison of notes, the scientists believe they can determine whether the continents are shifting and if so in what direction and at what rate of speed.

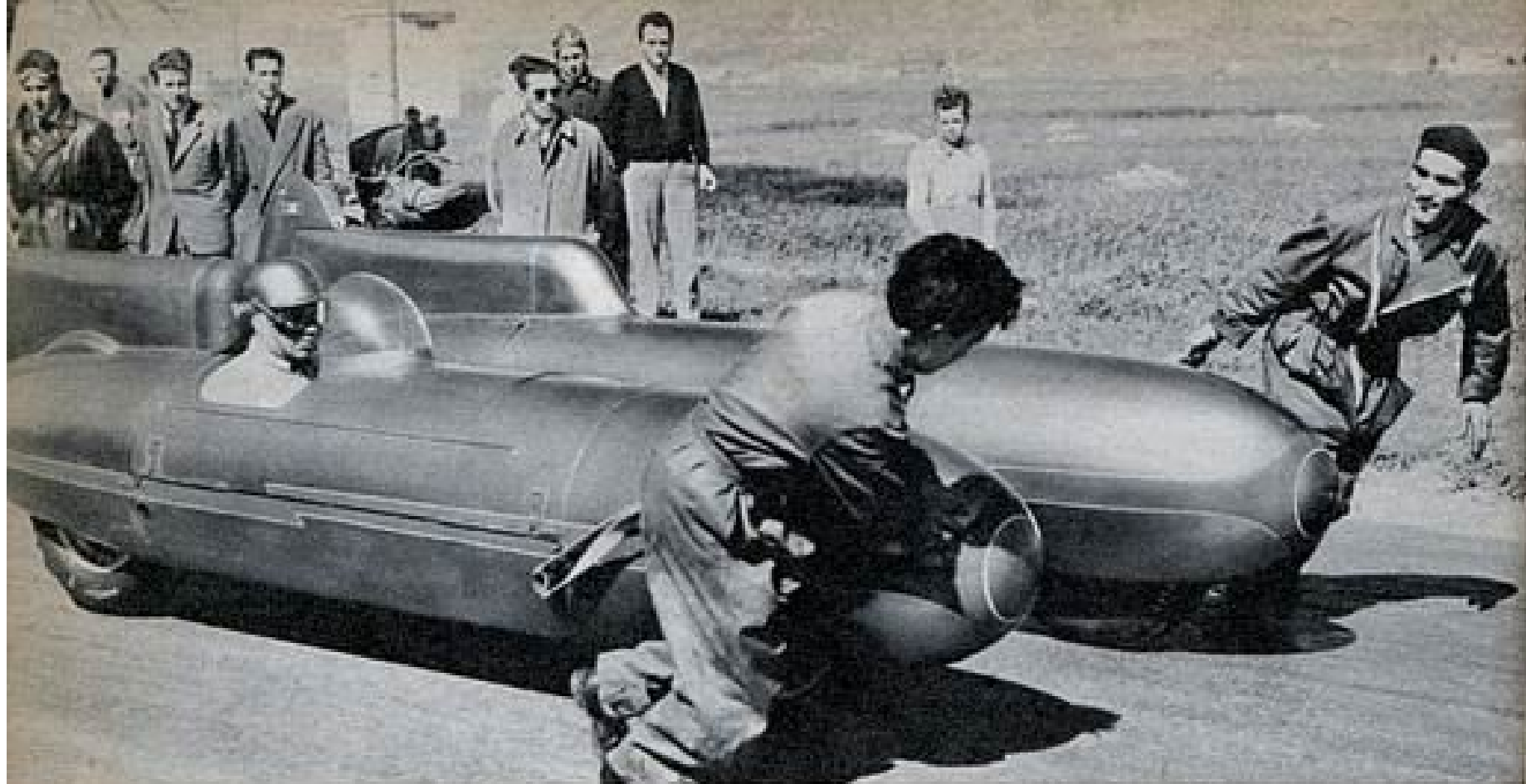
Oceanographers have made exhaustive surveys and have determined that the lost North Atlantis had many of the same physical characteristics exhibited by our modern day continents.



Astronomers are shown checking the drift of continents. Their findings will be checked with observations ten years hence to learn how fast the continents move.



Is this a message from the people of the lost South Atlantis? Dr. Rafael Requena, Venezuelan government official and archaeologist of note, believes it is. As yet, he has been unable to decipher the inscriptions. He is hard at work on the task and hopes that by finding the key to the ancient language he will unravel the story of man's life upon earth.



Double Bullet on Wheels

By Michael Stern
MI's European Correspondent

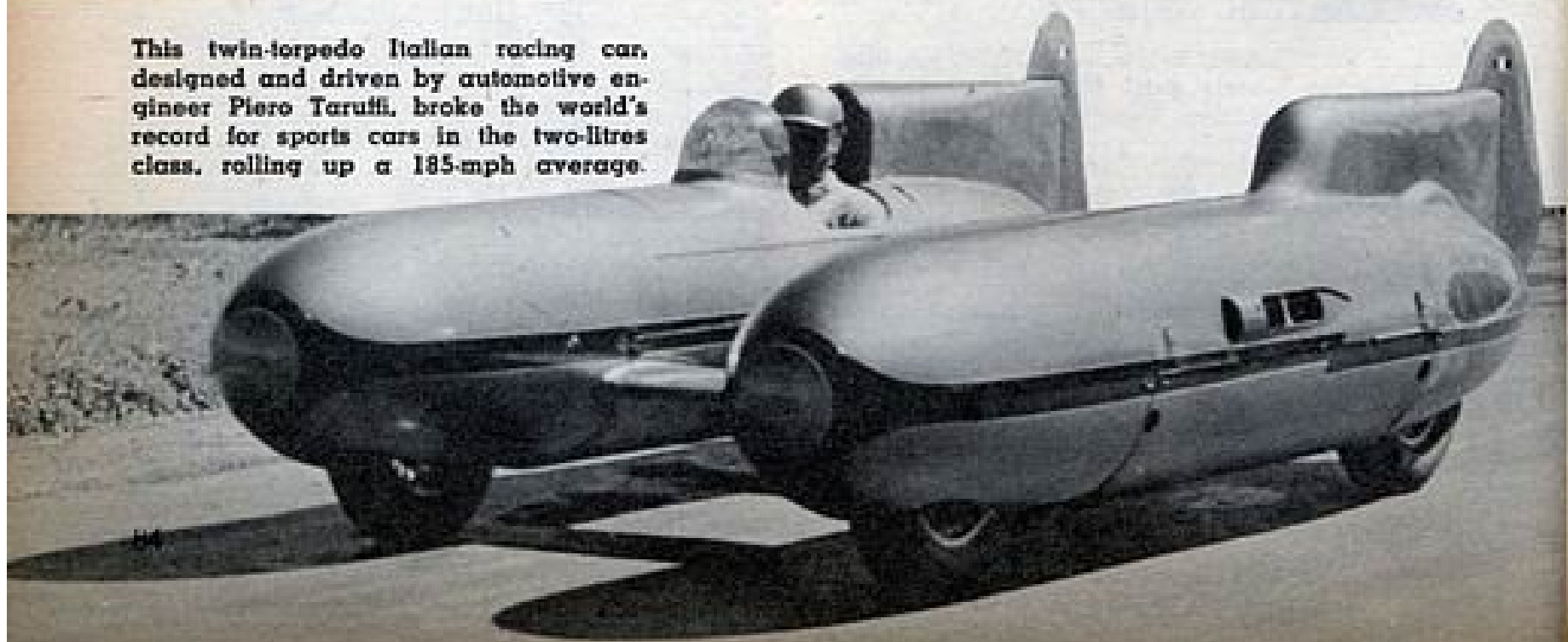
AN amazing contraption, I thought, as the odd-looking car was unloaded from a truck onto the Appian Way, just south of Rome. The kind of vehicle that springs full-grown out of fantastic comic books. But, it was an automobile, all right—a pair of sleek silver-and-blue torpedoes, shaped very much like the deadly fish launched by submarines, connected by two thin strips of beveled aluminum.

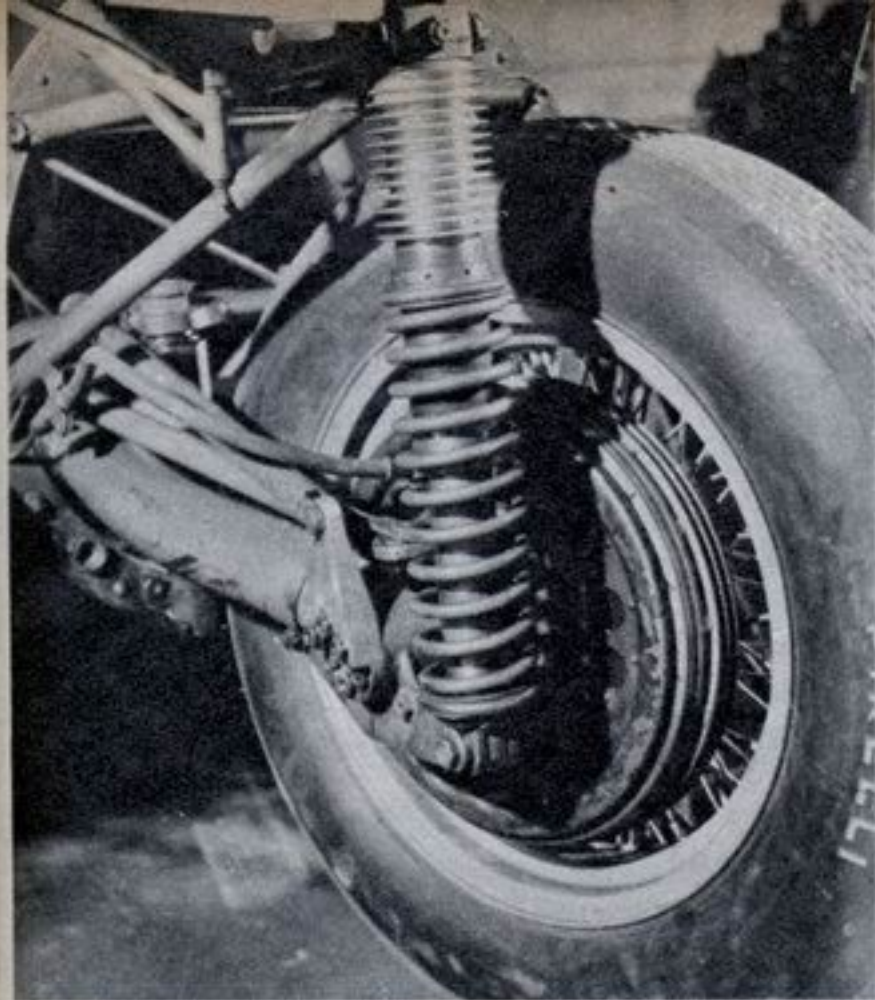
I was one of the handful of racing enthusiasts and official timers who had traveled to this dangerous stretch of two-lane macadam road flanked by deep ditches out of which grew huge trees. Most of us had

faith in the radical machine because it had been built—and was being driven—by Piero Taruffi, a brilliant automotive engineer and one of the world's best racers.

The wheels were separately suspended and absolutely independent. This suspension, instead of being parallelogramed sideways, as is the case with American cars, functioned from front to back. The motor was a standard Maserati four cylinder, 1720 cc with four forward speeds. Power from this motor was transmitted to the rear wheels by a chain drive, as in a motorcycle. The tail fins sticking up from the torpedoes were adjustable [Continued on page 163]

This twin-torpedo Italian racing car, designed and driven by automotive engineer Piero Taruffi, broke the world's record for sports cars in the two-litres class, rolling up a 185-mph average.

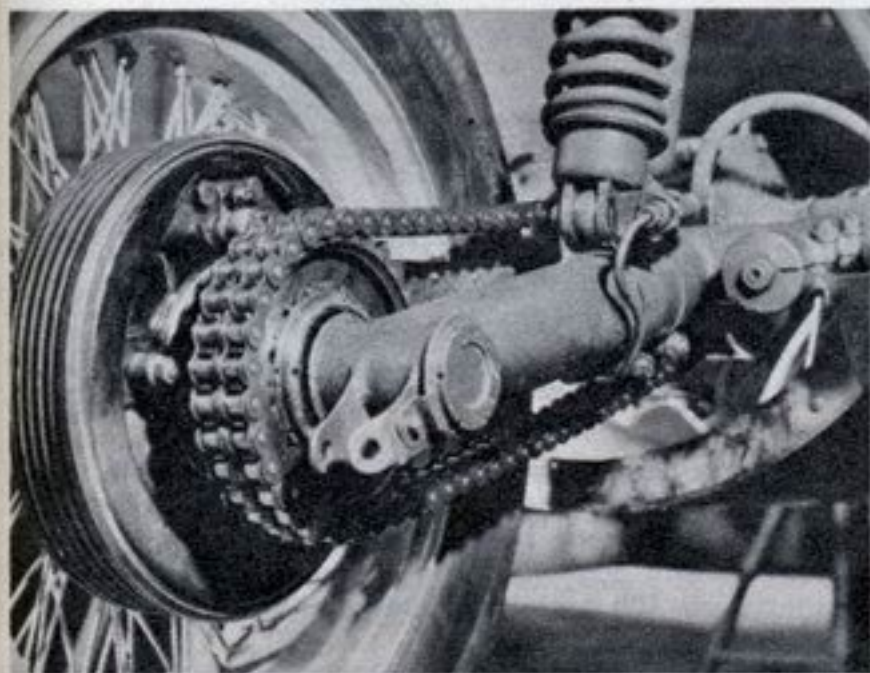




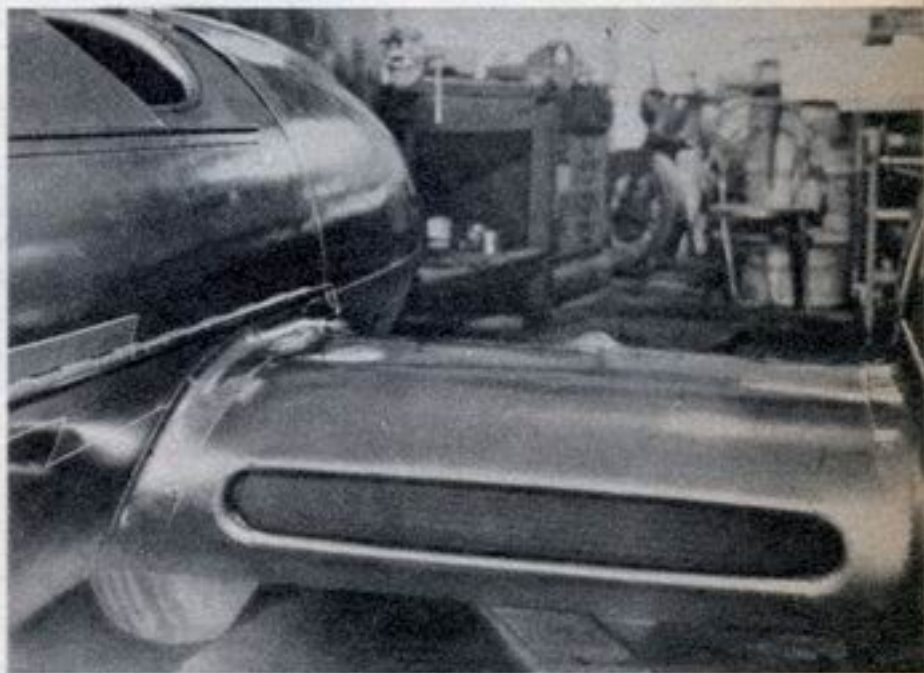
Wheels are absolutely independent—this left front wheel is suspended from a steel elbow. Note the coil spring and hydraulic shock absorbers.



Designer-driver Taruffi checks the Maserati engine located in the left torpedo of the automobile. The 280-hp engine has four speeds forward.



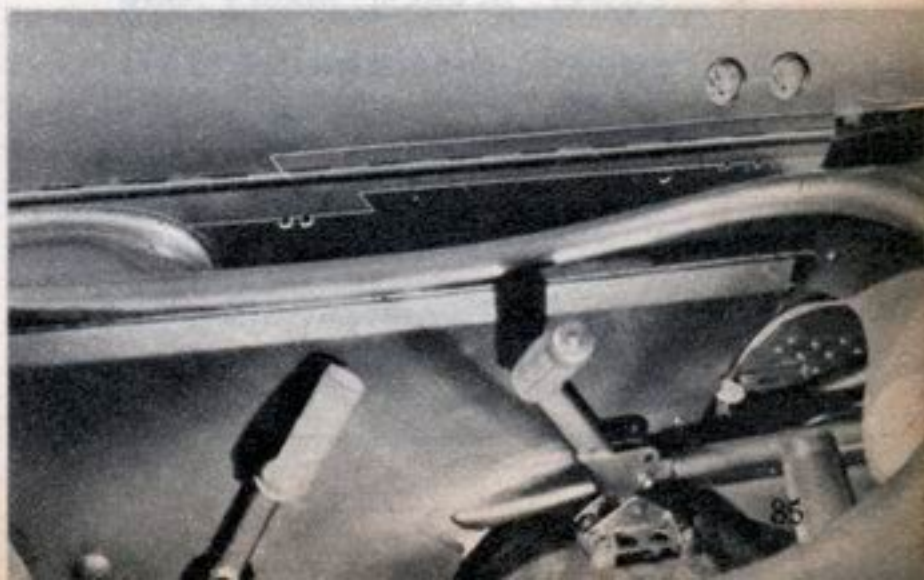
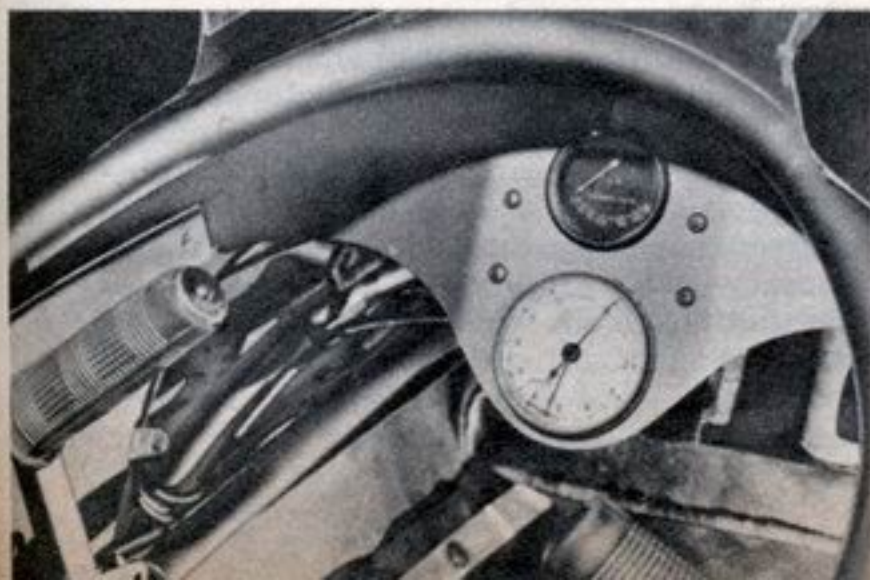
Power from the Maserati four-cylinder engine is transmitted to the rear wheels by motorcycle-type chain drives as on this left rear wheel of the car.



Rear housing which connects the twin torpedoes also contains the radiator of this radical Italian machine. The torpedoes have adjustable tail fins.

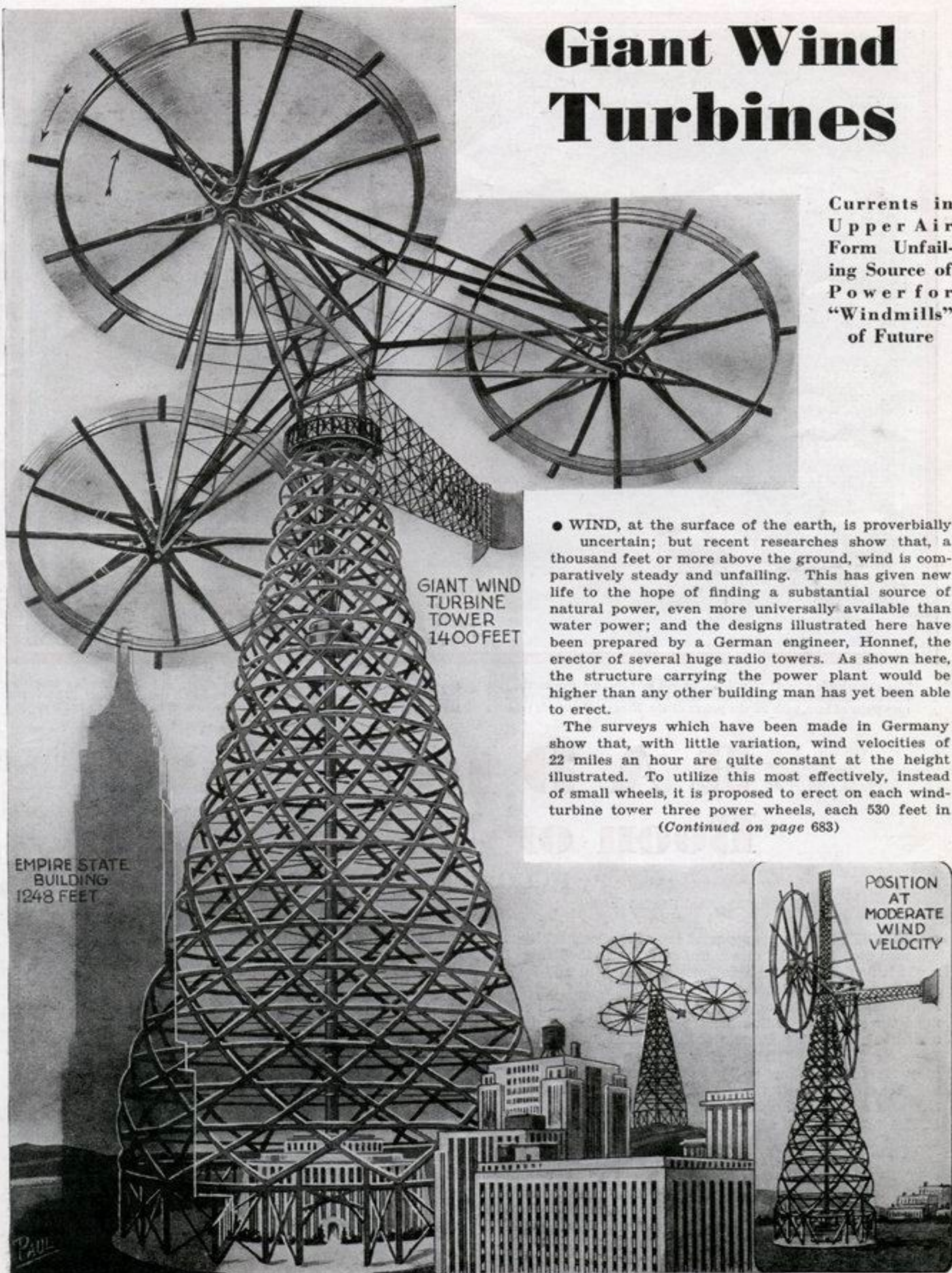
Driver's compartment in right torpedo has deep scoop seat. Water temperature and tach dials are on dash. Note steering arms at left and right.

Two tiny gauges at upper right are oil and gas indicators while lever at left is for shifting gears. Driver must keep legs straight forward.



Giant Wind Turbines

Currents in Upper Air Form Unfailing Source of Power for "Windmills" of Future



● WIND, at the surface of the earth, is proverbially uncertain; but recent researches show that, a thousand feet or more above the ground, wind is comparatively steady and unfailing. This has given new life to the hope of finding a substantial source of natural power, even more universally available than water power; and the designs illustrated here have been prepared by a German engineer, Honnef, the erector of several huge radio towers. As shown here, the structure carrying the power plant would be higher than any other building man has yet been able to erect.

The surveys which have been made in Germany show that, with little variation, wind velocities of 22 miles an hour are quite constant at the height illustrated. To utilize this most effectively, instead of small wheels, it is proposed to erect on each wind-turbine tower three power wheels, each 530 feet in

(Continued on page 683)

Plans for these great power plants, to generate 30,000 horsepower, have been prepared by a German engineer after a study of currents in the upper

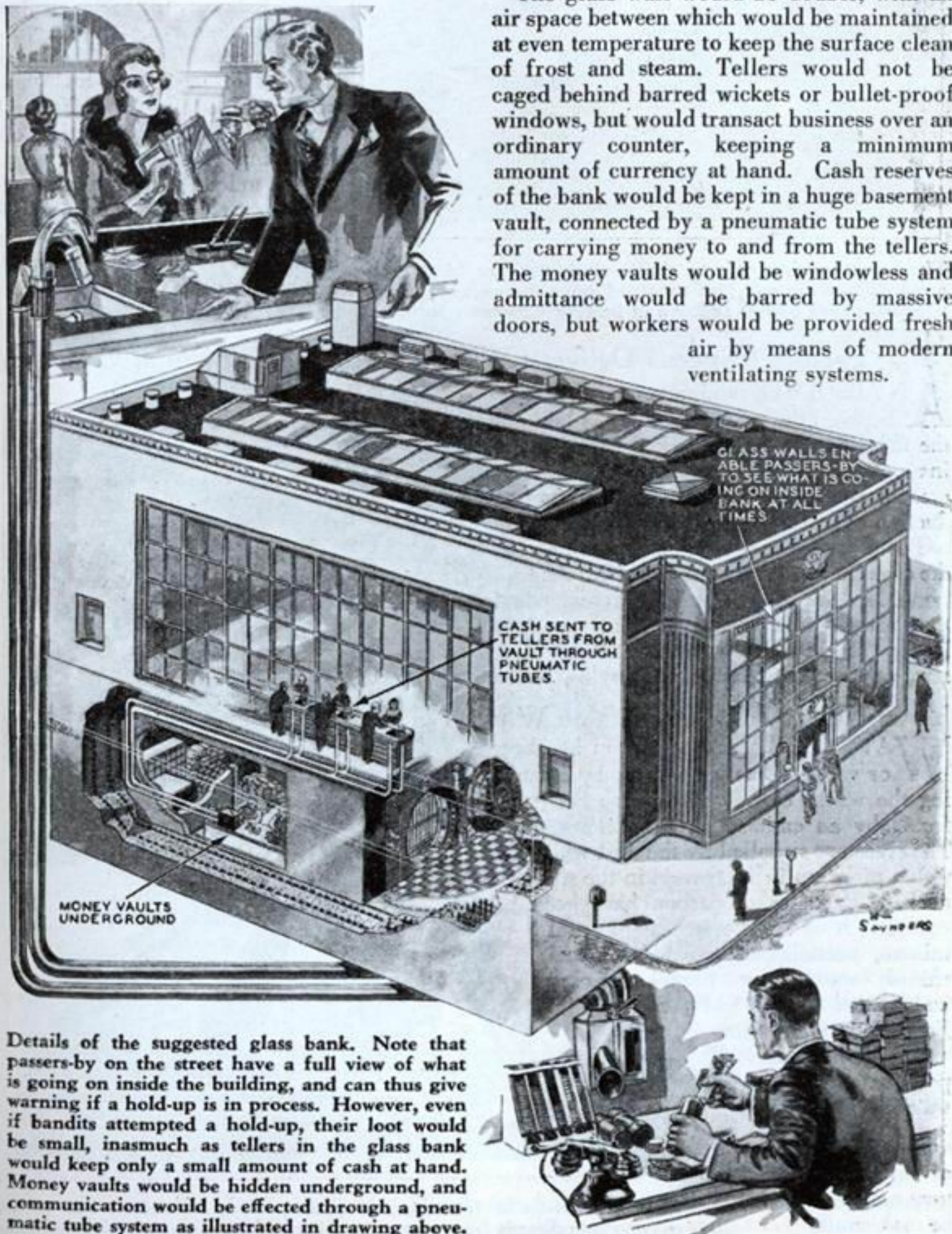
air. They adjust themselves automatically to varying wind velocities; in the larger picture presenting only the edges of their wheels to a high wind.

Glass Banks Will Foil Hold-Ups

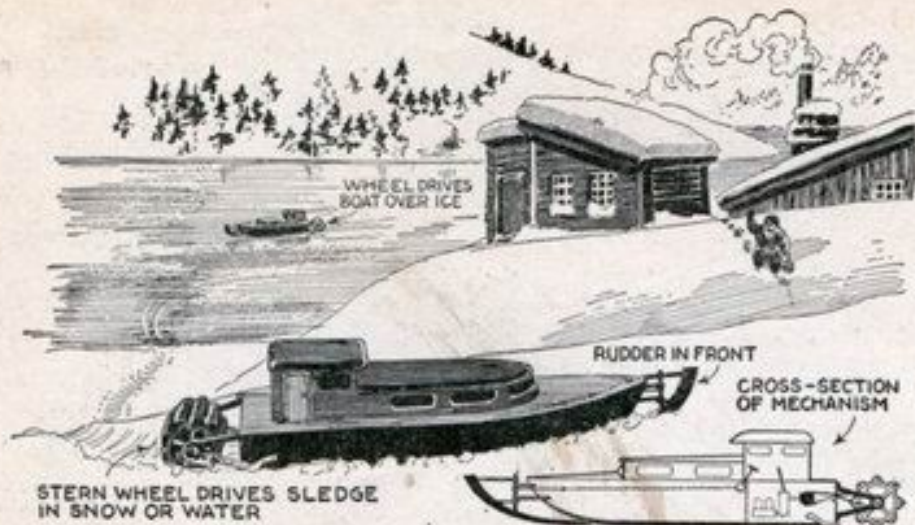
BANK hold-ups may soon become things of the past if the common-sense but revolutionary ideas of Francis Keally, New York architect, are put into effect. He suggests that banks be constructed with glass walls

and that office partitions within the building likewise be transparent, so that a clear view of everything that is happening inside the bank will be afforded from all angles at all times.

The glass wall would be double, with an air space between which would be maintained at even temperature to keep the surface clean of frost and steam. Tellers would not be caged behind barred wickets or bullet-proof windows, but would transact business over an ordinary counter, keeping a minimum amount of currency at hand. Cash reserves of the bank would be kept in a huge basement vault, connected by a pneumatic tube system for carrying money to and from the tellers. The money vaults would be windowless and admittance would be barred by massive doors, but workers would be provided fresh air by means of modern ventilating systems.

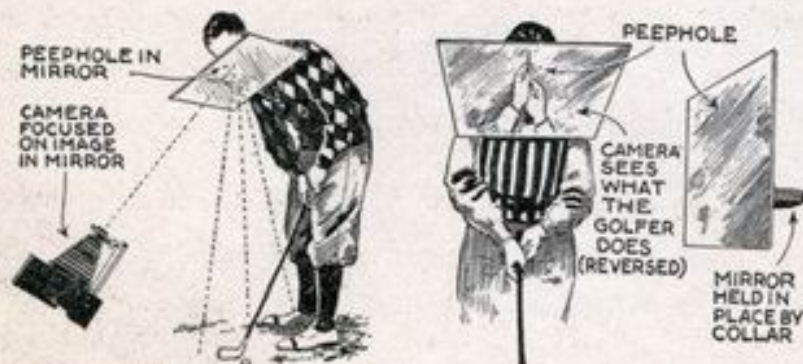


Details of the suggested glass bank. Note that passers-by on the street have a full view of what is going on inside the building, and can thus give warning if a hold-up is in process. However, even if bandits attempted a hold-up, their loot would be small, inasmuch as tellers in the glass bank would keep only a small amount of cash at hand. Money vaults would be hidden underground, and communication would be effected through a pneumatic tube system as illustrated in drawing above.



STERN WHEEL DRIVES SLEDGE IN SNOW OR WATER

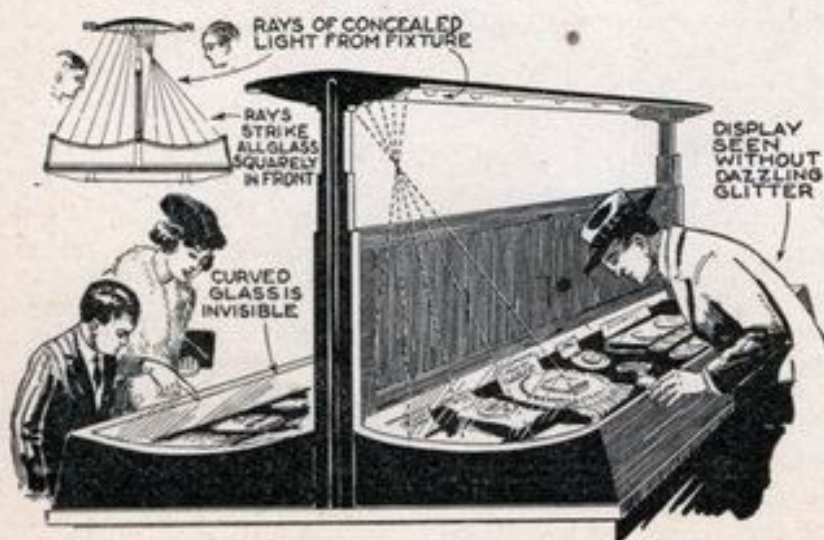
This vehicle is a new attempt to solve the problem of universal transportation, at least in a region of snow and ice. Stern-wheel boats and motor sledges have both been used before, but this combines them. The center of gravity is well behind, so that it will slip through snow. Inventor, Teofil Chlebowski (U. S. Patent 1,959,523).



A stunt for photography, especially of the commercial type, is devised by Palmer Shannon and John Wilson Royer (U. S. Patent 1,973,665).



The scientific-mechanical practical joker will enjoy this super-gadget, invented by C. T. Joslin (Patent No. 1,973,567).



By applying optical principles, Gerald Brown, an English inventor, has made glass invisible. The same principle may be applied to windows. (U. S. Patent 1,975,001).

These are patents, or foreign inventions, and we cannot give the addresses of the makers. Patents should be obtained direct from the Patent Office.

NEWEST

Recent Inventions Interesting From the Scientific and Mechanical Viewpoint

● EACH month, about five thousand patents are issued from the patent office at Washington, exclusive of trademarks, but including design patents. Of these, the largest proportion are intended for purely technical applications and as improvements on machinery previously in use, and are therefore of limited interest. On the other hand, many are novel in their utilization of known principles; and it

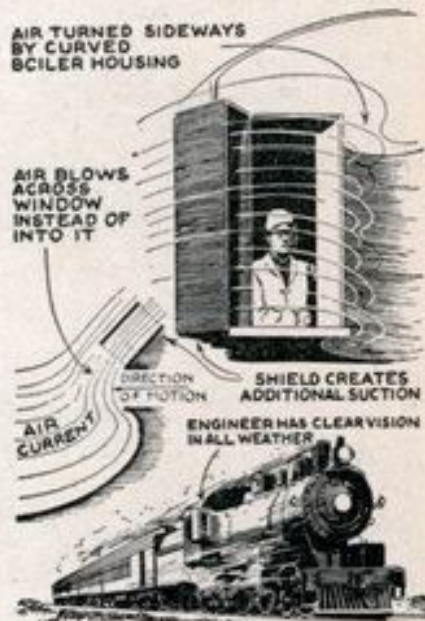
is our endeavor to present here those of interest to any mechanically-inclined reader, whether or not they can be used by the public.

For instance, that pictured at the upper left is a new version of an attempt to secure a universal travelling vehicle. The air propeller, often used on such craft, is suitable only at high speed, while the stern wheel can dig in where going is rough. It would probably find use in the lake and marsh region of Arctic and sub-Arctic America.

At the upper right, an application of pure science. On locomotives in France, the glass which often obscures the engineer's vision is done away with; yet, by proper shaping of the shields, no air is driven into the cab. Much experimenting was necessary to make this practical. Another example of mathematical work is the show case (lower left), where the glass becomes invisible as if it were not there.

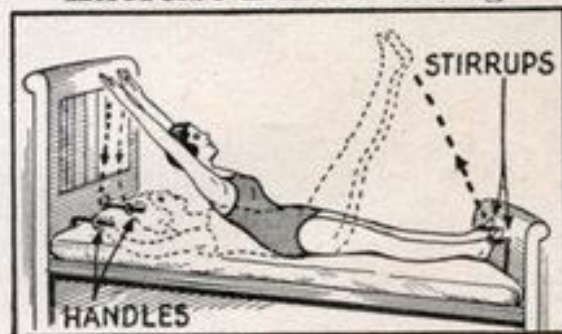
The refrigerator truck (lower right) is an application of a principle used in the operation of aircraft radio sets in past years.

Other ideas here shown are more obvious.

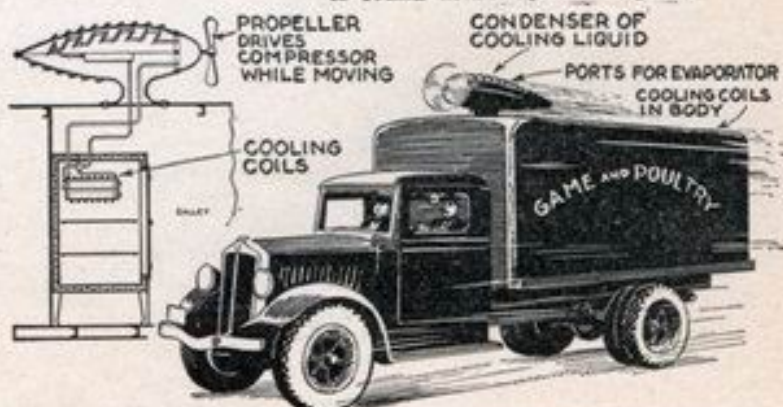


A window without glass keeps out snow, rain and cinders! Clever, these Frenchmen.

Exercise Before Rising



A simple invention for exercise at least effort is found useful by the English.



This may be applied also to an airplane, or any vehicle moving at high speed.

PATENTS

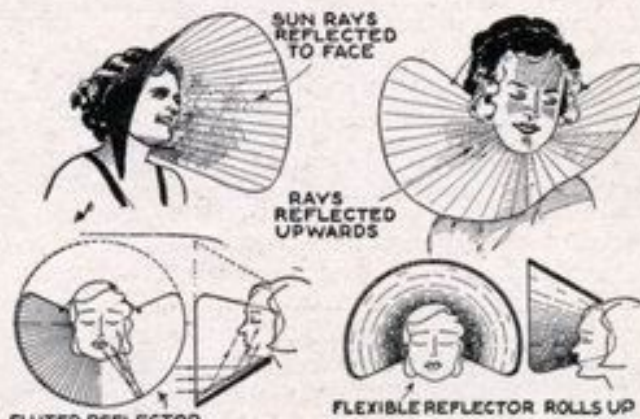
● THE patent illustrated at the upper right deals with the problem of an aircraft designed for such high speed that it can hardly be got off the ground—since the take-off speed is very high. But, with a large plane, of the load-carrying type, the high-speed (stratosphere) plane might be lifted from the ground by the slower craft; which then gets up a speed of a hundred, or hundred and fifty miles an hour. The angle of the wings of the upper plane is increased until it is lifting its own weight; the catches holding it are released—and the speed plane soars away on its own. The booster plane returns to ground, perhaps for another plane; and so on. Having used up its load—perhaps dropped it in the form of bombs—the speed plane may be able to descend at a practical landing speed—or it might even be picked up in the air by the slower plane and lowered to ground.

The photoelectric signalling system shown below may seem complicated; but has been applied in Europe, and has the support of traffic authorities. As the diagram makes clear, the driver of an overtaking car can make clear his desire to pass, by an unmis-

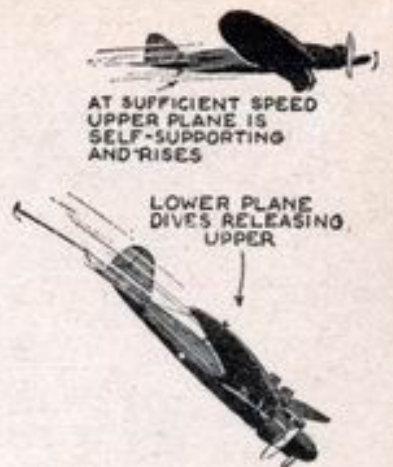
takable signal; and the driver of the car ahead indicates that the way is clear. It may become as standard as the present "Stop" light.

The parking meter shown is the invention of the well-known economist, Roger W. Babson. The patent contemplates, first, a lighting system to show when parking time is up; second, a coin-box meter whereby parking privileges may be obtained at public grounds on a pay-in-advance basis.

Below, we have a device which has already been in use in foreign countries for those desiring local application of sunlight. Lower left corner, an invention based on the theory that infra-red radiation is reflected from platinum in the form of longer, visible light rays.



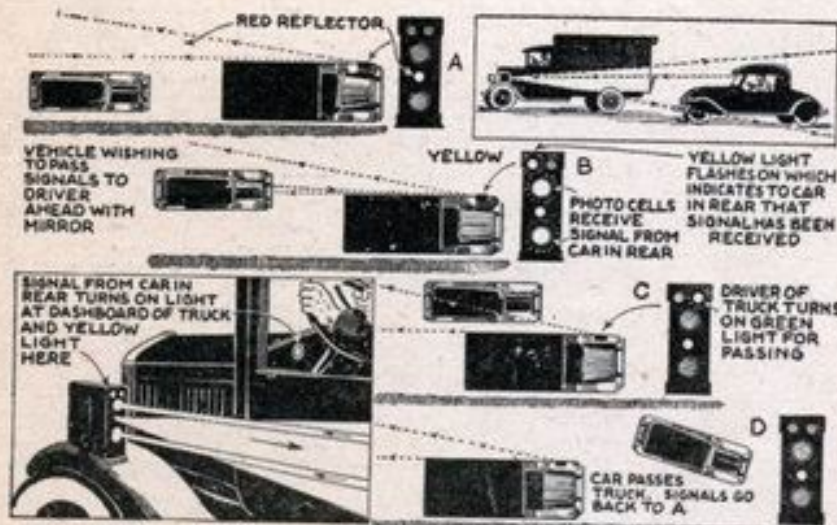
A German invention for regulating evenly the quick coat of tan. (U. S. Patent 1,974,820)



R. H. Mayo's invention for high-speed plane launching. (Patent 1,974,684)

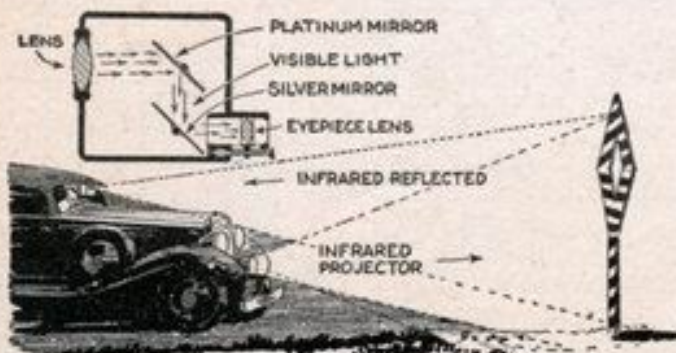


Roger W. Babson's car parking meter is Patent No. 1,973,275.



Already in use in France and Germany to facilitate traffic conditions. More complicated, though more effective, than honking the horn.

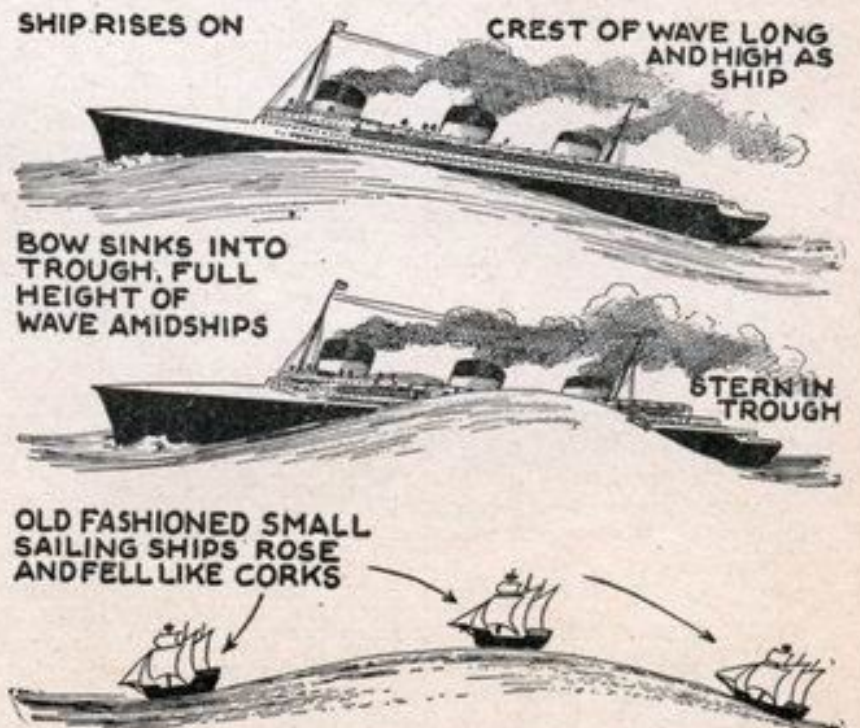
Heat Rays to Light Road Through Fog



Many inventors have tried to use the power of infra-red (heat) rays to see through smoke and fog. Frank J. Markosek has taken out Patent 1,969,852 on this simple method of doing so. We prefer to see a demonstration before passing on its practicability.

Why Biggest Ships Meet Biggest Waves

● MARINERS keep reporting bigger waves at sea. The *Bremen* and the *Leviathan*, perhaps, hold the record; though the U.S.S. *Ramapo* encountered waves 112 feet high, by calculation. As bigger ships are built, they will find the waves higher and higher, for reasons indicated below.

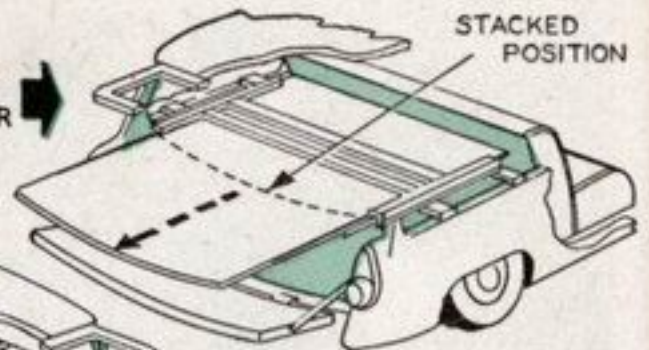


This shows why the bigger a ship is, the more she feels the force of a monster wave. Sailors in a small vessel have no way to judge the wave's full height.

PARADE OF

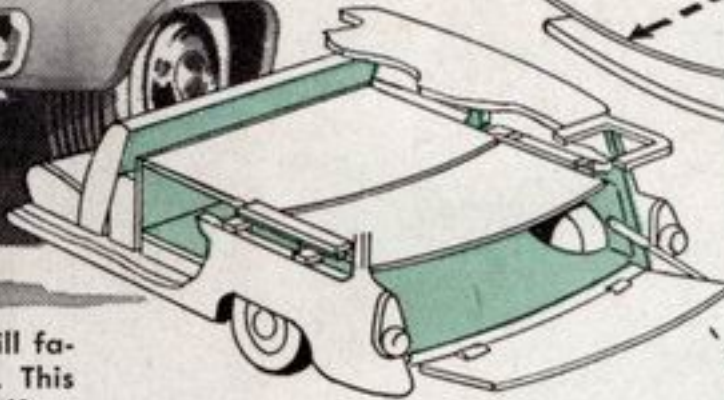


PLATFORM FULLY EXTENDED TO REAR

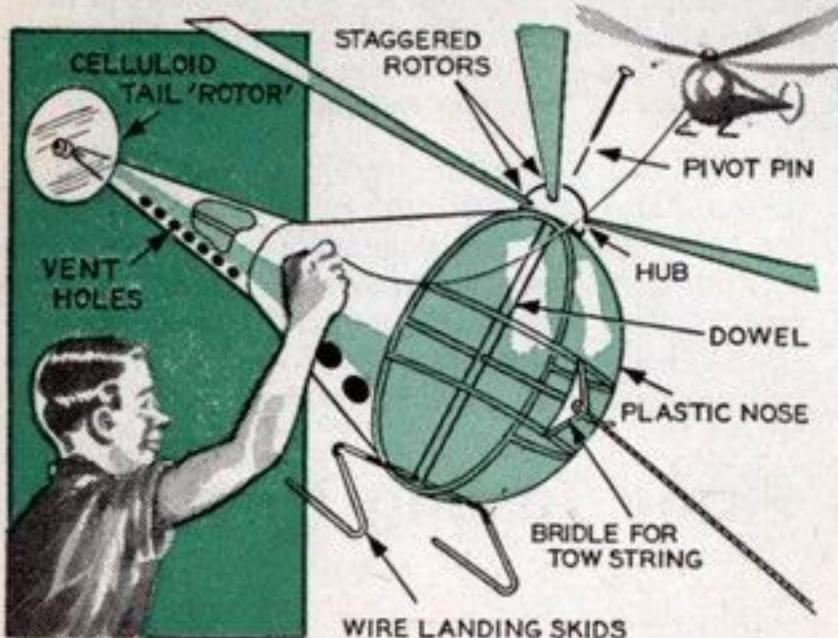


STACKED POSITION

REAR SEAT COLLAPSED AND PLATFORM FULLY EXTENDED FORWARDS



Station Wagon Auxiliary Platform will facilitate your loading and unloading. This sliding tray unit forms an extra shelf or set of shelves for easy storage of trunks, boxes and small items that often get mislaid in a fully loaded station wagon. Trays are spring loaded for easy sliding. Patent No. 2,934,248. Jack A. Lown, Minneapolis, Minn.



'Copter Kite' looks like the real thing when it is airborne. The kite has a three-bladed rotor that revolves about a simple bearing while the dummy tail rotor disc appears to be spinning as it glints in the light. Construction is light and simple. Patent No. 2,893,663. Earl L. Wilson, Los Angeles, Calif.



Adjustable Umbrella Holder leaves your hands free for carrying parcels and lighting a pipe or cigaret. The light harness goes over the shoulders and can be adjusted to the most comfortable fit. When it stops raining, the umbrella can be slung from tie loops at the back. Patent No. 2,926,826. William Conrad, Frackville, Pa.

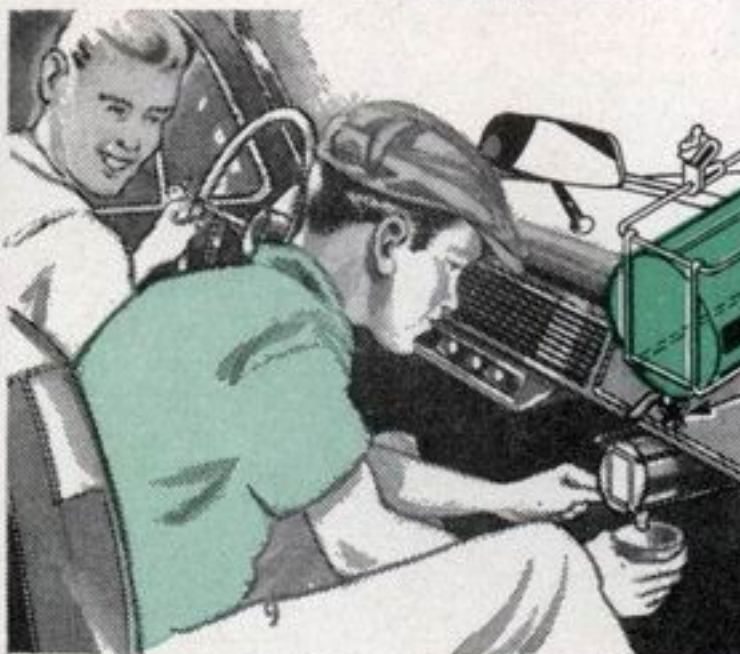
Combination Head-Rest and Sun Shade is just the thing for a hot sunny day at the beach. It folds up easily and in this form may be used to carry swim suits, towels and other small objects. A zipper pocket in the cushion holds the articles. Patent No. 2,932,833. Katharina Wambach, Philadelphia, Pa.

• For more complete information on any of the inventions shown here, you may order copies of each original patent by sending your request with the patent number to Commissioner of Patents, Department of Commerce, Washington 25, D. C. Enclose 25¢ in cash for each patent.

NEW PATENTS

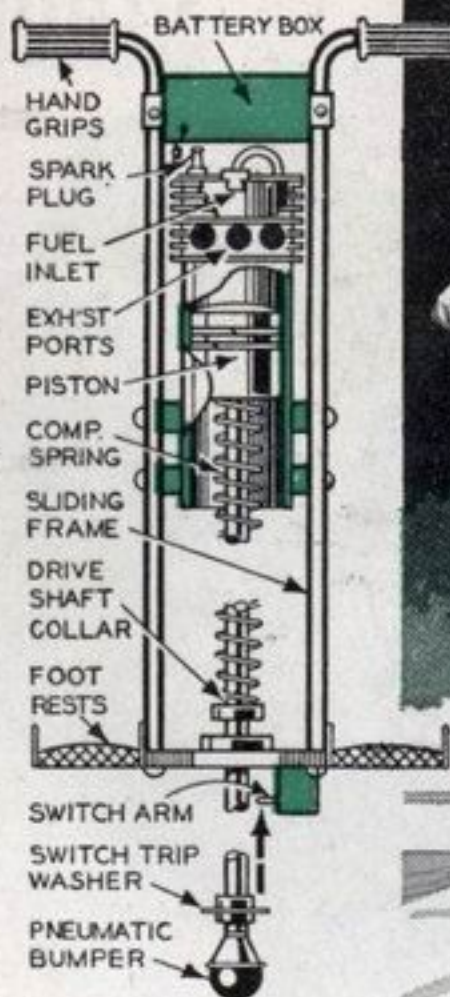


Tie-On Ice or Water Bag. This simple little invention makes it possible to attach a small ice bag or to apply heat to any part of the head or body. It is suitable for use by ambulatory patients for no effort is required to keep it in place. A swivel collar fits around the neck and is held in place by the screwcap top. This permits the user to adjust the bag to any desired position. Patent No. 2,919,735. Leona E. Prietzsch, Venetia, Pa.

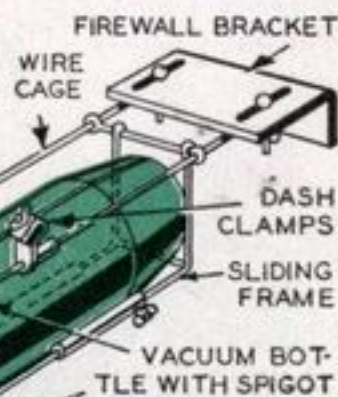


Auto Fountain. This beverage container for automobiles is easily installed under the dash and consists of a wire cage that may be adjusted to take various size vacuum flasks. Addition of a spigot to the flask or bottle is all that is needed to dispense water or non-alcoholic drinks while speeding along the turnpike. Patent No. 2,915,082. Evart V. Shaw, Garland, Tex.

Glare Shields for Automobiles fasten to the hood of your car and are claimed to be equally effective day or night. The rows of staggered flanges are brightly polished and reflect sunlight or headlight glare upwards and away. Patent No. 2,930,650. Roy J. Vosen, Coeur d'Alene, Idaho.



PARTIAL SECTION



Powered Pogo Stick is made up of a king-sized 1-cylinder engine fired automatically by a trip switch that is placed strategically beneath the foot rests. Will this gadget require a vehicle license? Who knows? It ought to be something to see if these things get into production and then into the hands of some of the drivers you meet on the roads today. Patent No. 2,929,459. Gordon Spitzmesser, Elwood, Ind.



JANUARY 1961



From the outside, the *Kugelhaus* looks only big enough to garage the Volkswagen parked next to it. But inside there's a complete scaled-down home, with kitchen, bathroom, and a combination bedroom-living room.

Portable Globe House for Well-Rounded Living

Only 15 feet in diameter, low-cost home offers all the conveniences of a larger one. And, it can be delivered by boat, truck or even helicopter

concrete, metal or plastic. Just one inch of concrete gives good results, says the inventor, Dr. Johann Ludowici. The house can be completely assembled in the factory—with whatever furniture or other equipment is wanted—before delivery. As portable as a house could be, it can be flown to wherever you want it by helicopter, towed in by boat (it

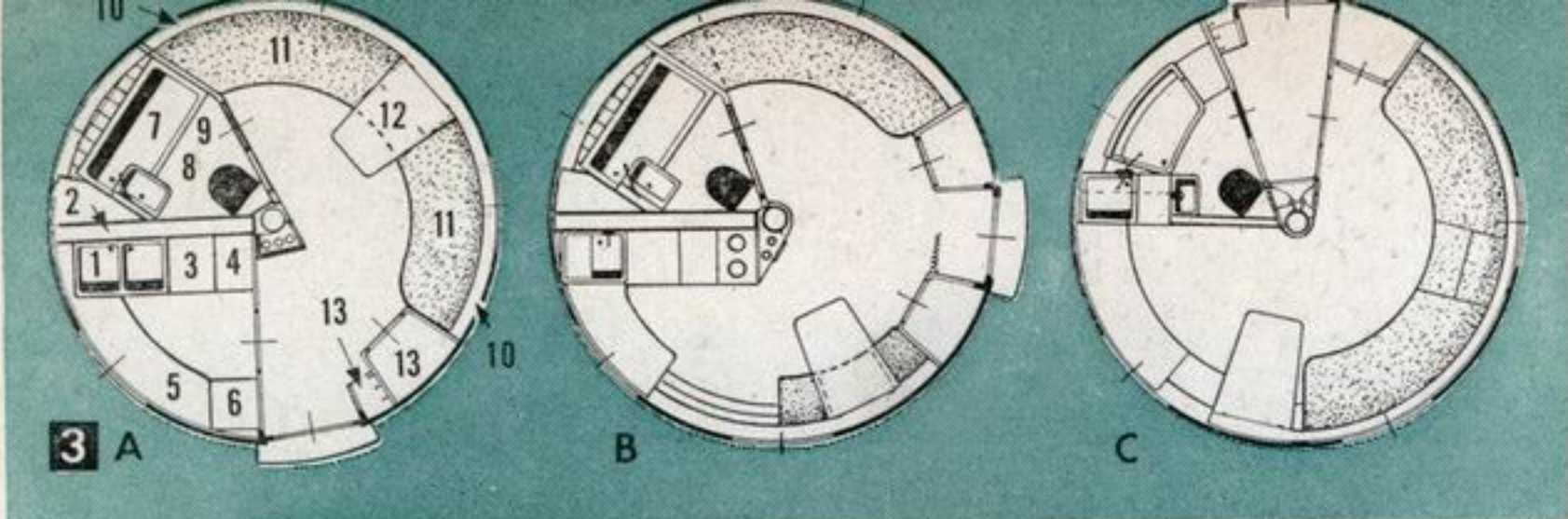
It looks like a satellite that just fell out of orbit.

But actually it is a down-to-Earth, low-cost portable home—with all the modern conveniences you would expect to find only in a more usual-looking (and usual-priced) house.

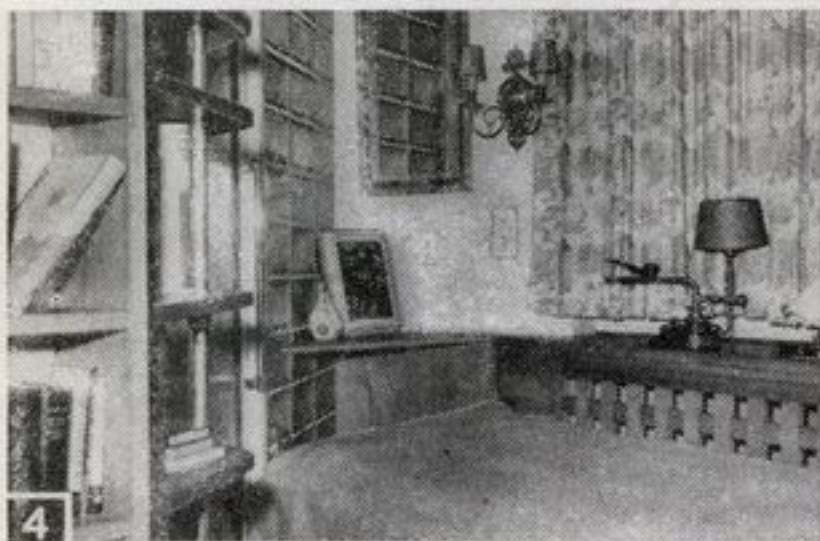
Called the *Kugelhaus* (*Kugel* is German for "ball," and *haus* means just what it sounds like), it is nothing more than a 15-ft.-diameter hollow ball. Its eggshell-like construction is of either lightweight reinforced

Looking through a window into the roundhouse's kitchen. In front of the girl are a full-size sink, a range, and a work-top cabinet, and the wall is hung with cabinets and shelves—just as in any other house. To the girl's left, but out of sight, is a refrigerator next to more counter space.





A wide variety of room arrangements are available in the *Kugelhaus*. Here are three typical floor plans: (1) kitchen sink, with cabinets over it; (2) the "mechanical core" that contains all the plumbing and wiring needed; (3) range; (4) hot air heater; (5) counter; (6) refrigerator; (7) bathtub; (8) sink; (9) toilet; (10) shelves; (11) sleeping couches; (12) fold-down table, and (13) closets.



View of one end of combination bedroom-living room shows sleeping couch and shelves. Note the shelf running along wall behind the couch. Maximum use is made of the roundhouse's space.

floats), or, more conventionally, carried on a truck.

Of course, if you are the type of person who collects things and needs a lot of space to store them, or if you have a big family, you probably would not want to live in a *Kugelhaus* permanently.

But its scaled-down kitchen, bathroom, and bedroom-living room make it ideal for use as that weekend or summer home you've always wanted but couldn't afford. It could also be a low-cost, easy-to-maintain retirement home, and our Air Force has shown interest in it as possible airmen's quarters at emergency airfields.

Bigger Than It Looks. You could use it as permanent housing if you wanted to, though, and comfortably, since when you take a look inside you find that its appearance of smallness is deceptive.

Dr. Ludowici, a German engineer and inventor, has worked a veritable miracle in his efficient use of the *Kugelhaus's* space.

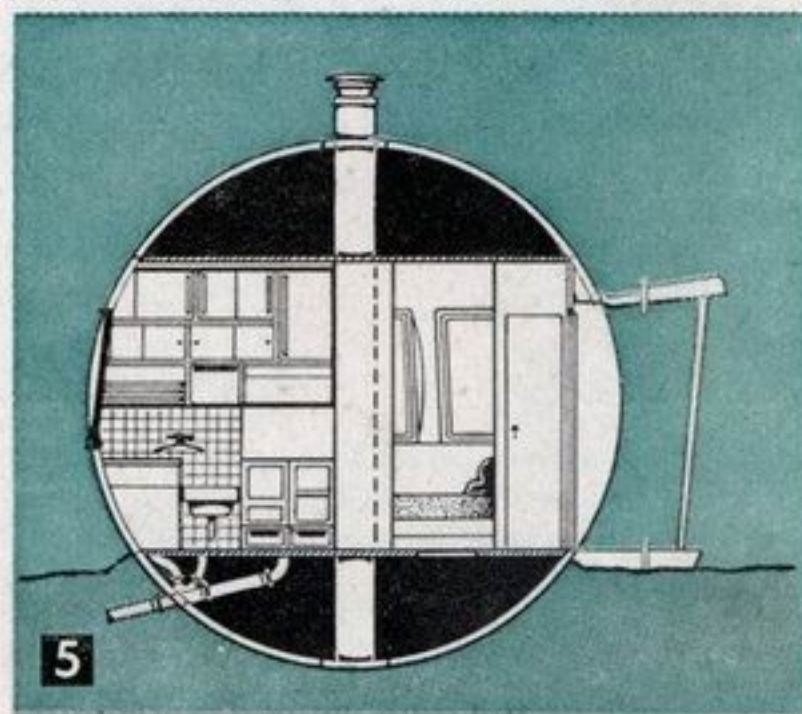
The house's diameter of about 12 ft., 4 in. at the floor level gives it a total floor area of about 120 sq. ft. That is roughly the same

space you would find in a typical bedroom of a more conventional house.

A number of different floor plans are available (Fig. 3), but all have the same area and share these features:

- A kitchen, with all the necessities. There is a stove, either bottled-gas or electric; a refrigerator; a stainless steel sink, and wall-hung cabinets and storage shelves.
- A bathroom, with bathtub-and-shower, sink, toilet, and more cabinets.
- A combination bedroom-living room that typifies Dr. Ludowici's triumph of planning and ingenuity over lack of space.

Occupying about half the area of the house, the bedroom-living room has two foam rubber davenports set against the curving outside wall which convert to beds and which have large drawers built-in under them. A table folds down from the wall for eating or writing. More shelves line the walls, and there



The *Kugelhaus* needs no footings or foundation; it's actually its own foundation, as shown in this sectional drawing. Note the storage space available in the "attic" and "basement" and the sewage pipes which connect mechanical core to outside lines. The ceiling is of fiber board on a wood framework, and the floor covering can be linoleum, tile or some similar material.

are two closets.

The areas above the ceiling and below the floor offer room for water tanks (in case there is no outside supply) or heating fuel tanks, as well as storage space for bulky items such as luggage, extra clothing, tools, books or whatever.

A "mechanical core"—or "installation wall" as Dr. Ludowici calls it—forms the partition between kitchen and bathroom and contains all the wiring and plumbing needed, as well as a warm air heater and chimney.

No Footings or Foundation.

Aside from its portability and good planning, the *Kugelhaus* offers another advantage: Almost no preparation of a building site is needed.

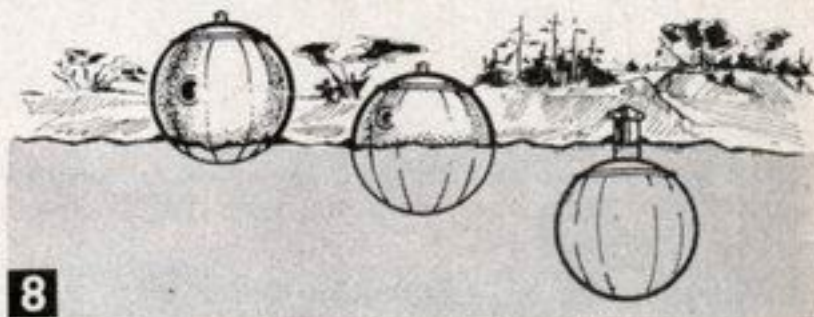
The house can be delivered fully furnished, and—instead of costly and time-consuming excavating, footings and foundation—it requires only the digging of a slight depression into which it can fit, along with utilities and plumbing hookups, (Fig. 5).

Its portability and quick-readiness for use, as a matter of fact, are the reasons that the roundhouse exists today.

It was designed at the request of the Belgian government, which wanted a low-cost small house that still had all the essential comforts. It had to be light and buoyant



Truck carries a *Kugelhaus* through the streets of London—a good example of its portability. Other roundhouses were floated up England's Thames River to an exhibition.



On the ground, partly underground, or all the way underground. The *Kugelhaus* can be installed in various ways, making it ideal for use as a tornado shelter if desired.

enough to be towed up rivers or flown into remote regions of Africa, where it would be used for worker housing.

So Dr. Ludowici, working in the small German town of Jockgrim-Pfalz, near Karlsruhe, came up with the *Kugelhaus*. He based his design on the principle, known to every geometry student, that a sphere contains the greatest possible volume for the least surface area—a principle little used in housing until now, except for the Eskimo and his igloo.

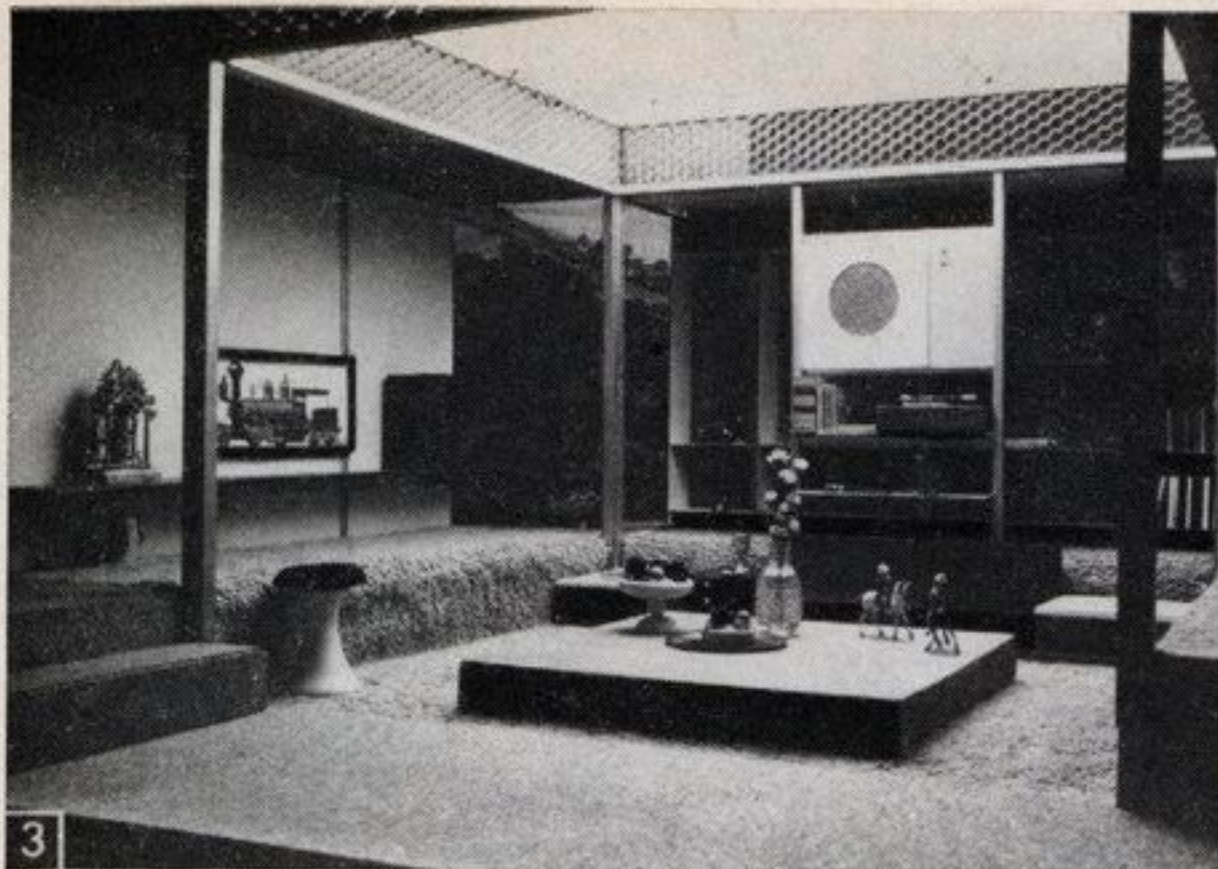
One model of the roundhouse is relatively light for its size, weighing only three to four tons, and was designed especially with water or air transport in mind, since it is easily carried by a heavy-duty 'copter such as the twin-turbine Vertol 107 shown on the cover.

A heavier model weighs eight to 12 tons, and it also floats, although it more commonly is transported on trailer trucks (Fig. 7).

Price of the *Kugelhaus* ranges between \$1,500 and \$4,500, depending on what furnishings are included. As of now, it is not sold in the United States, since transportation costs and import duties would raise its price considerably, says Dr. Ludowici. But a *Kugelhaus* exhibit in the library of the National Housing Center, Washington, D. C., recently aroused considerable interest; and Dr. Ludowici believes there is a good chance the house could be produced here and sold at low cost.—WAYNE WILLE.



Another example of how space is used to the utmost is this door-hung cabinet, with shelf on top.



Inside a model of the cube house. Many furnishings are built in as a part of the basic structure—such as the storage wall at the rear. Extender units fasten to cubes to enlarge rooms, add design flexibility and provide corridors.

skylights, made of several layers of translucent plastic for natural lighting during the day. In areas where glare is troublesome, vari-colored liquids could be pumped into the air space between the layers. At night, soft indirect lighting would come from lamps in edge coves.

To cover the sides of the cubes, you would choose from a wide variety of interchangeable wall panels, which could be just simple walls or could have built-in picture windows, furniture, storage cabinets or shelves (Fig. 5).

To increase the flexibility of the basic cube

and to provide corridors, 4 by 12-ft. extender units could be joined to the larger blocks. Where larger rooms are wanted, two or more of the cubes could be combined.

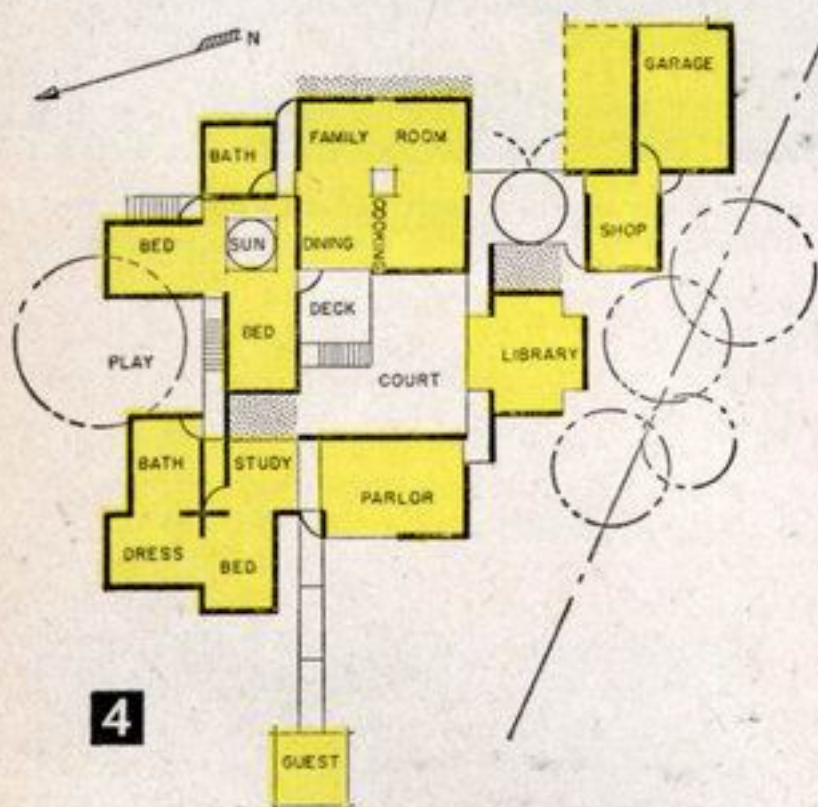
Why the helter-skelter room arrangement of the house shown in Figs. 1 and 4? It was carefully laid out that way to provide the utmost in privacy and quiet.

Massive walls—such as 3 ft. or so of concrete—will completely stop noise. But thin walls, like those in most homes, only muffle sounds, and in a factory-built house like Nelson's—where light weight is a must—unrestricted noise could be a serious problem.

So Nelson's solution was to separate the rooms and join them by corridors made of the smaller extender units. Since the cube house offers complete design freedom, it can be perfectly adjusted to the building site to provide the desired seclusion and quiet. The separated rooms also solve the problem of ventilation in areas where year-round air conditioning will not be built in. Small conditioner and heater units could be installed where wanted, or the insulated floor panels could be heated radiantly. In cold climates, aluminum panels could extend from the cubes to the ground to prevent cold air from blowing under the floors.

Easy Mobility and a minimum of on-site labor are necessary before homes can be truly factory-built and sold over the counter with anywhere near the same success as automobiles or refrigerators. The Industrialized House, by using only two basic building units and a variety of wall panels, fills these requirements.

The minimum number of parts could be manufactured on an assembly line and



Floor plan of the house shown in Fig. 1 illustrates how cubes and extender units can be combined into a flexible and efficient room arrangement.

- Use of lightweight anodized aluminum would eliminate many maintenance problems and the need for footings and foundations. Instead, the cubes would rest on aluminum cones, with a screw-jack between the cube and the cone to adjust for uneven ground levels.

- If desired, the house could easily be disassembled, packed on a trailer and moved to a new location.

Covering the Cubes. Nelson recognized that most people are used to getting light from above. So the cubes' roofs would be domed

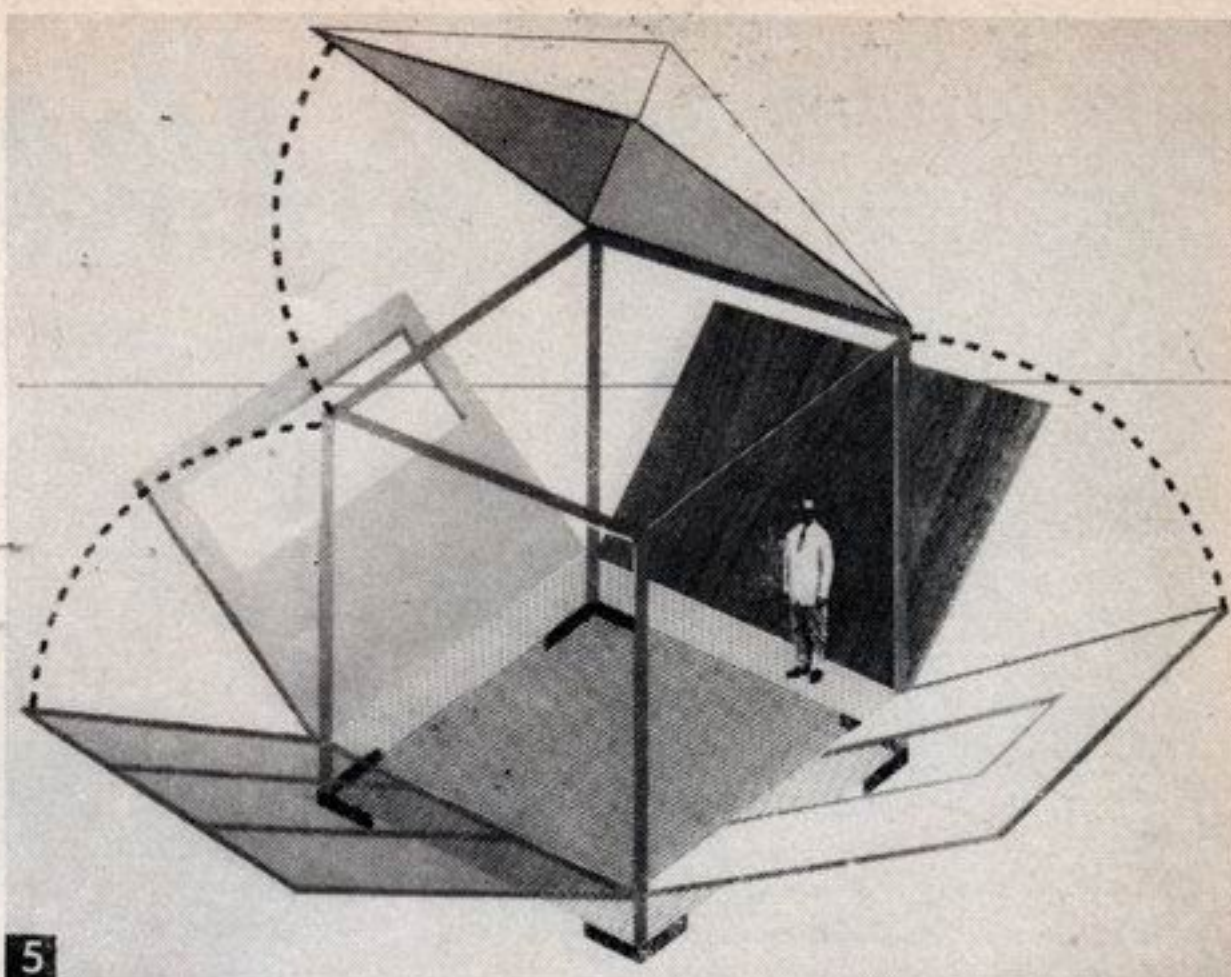
stocked in regional warehouses. You could shop in a store, pick out the building units you need, then have them delivered to your lot after having standard utility hook-ups installed at the site. Package units for heating or all-season air conditioning, kitchens and baths would fit into each cube as desired and would be independent of any large, overall system. A day after the components arrived, you would be living in your new house.

Then, suppose your company transferred you to another part of the country. Instead of going through the delays, expense and mental turmoil of selling your house and finding another, you could simply take down your cube house and ship it to your next location, along with your personal goods.

There, a day's work would see your house set up on a new lot. You would already feel at home in it, your furniture would fit it—and you might even decide to add another room or change the room arrangement, all for less than the cost of two real estate

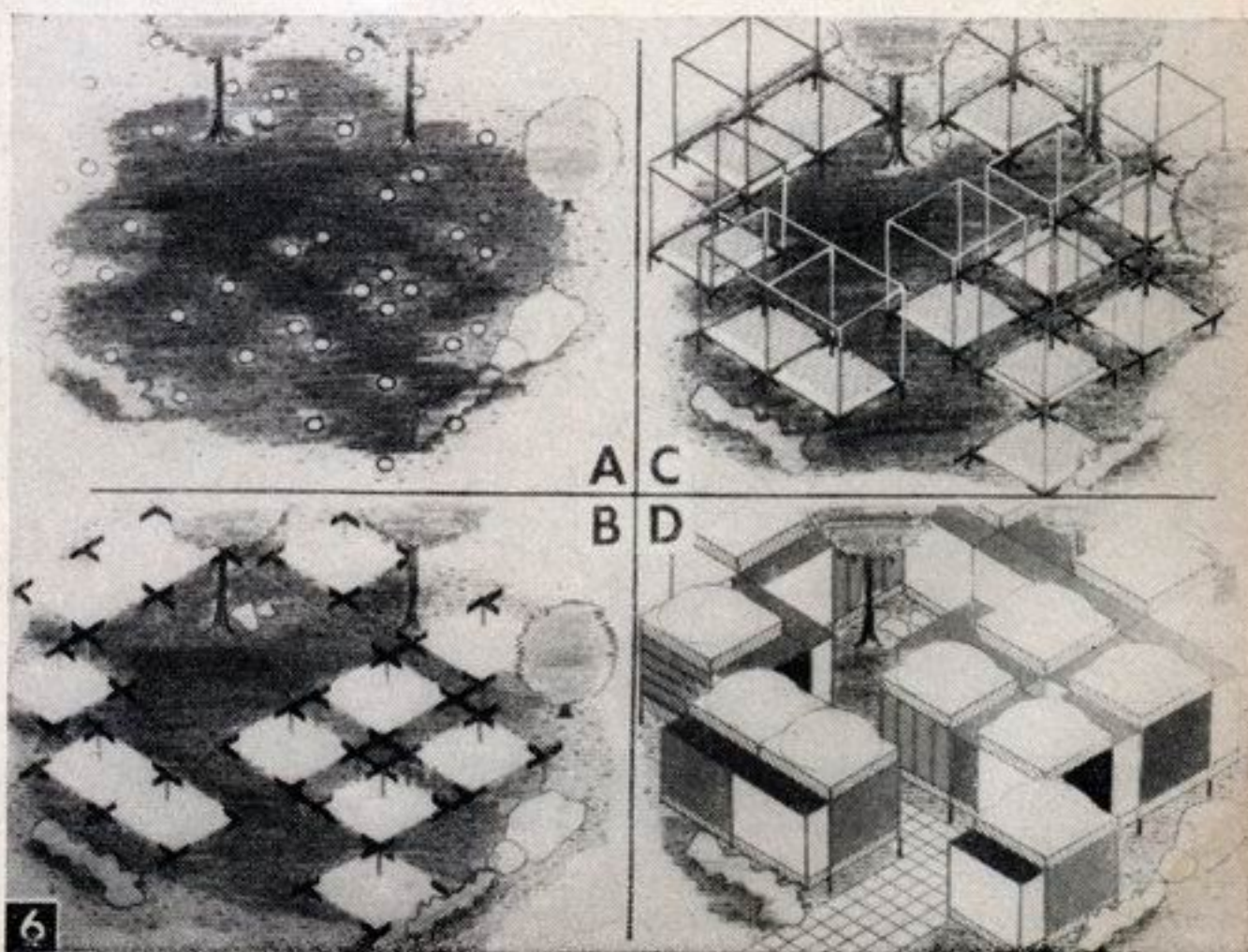
commissions and the intangible losses that come from the usual frustrations of selling, moving and rebuying.

As yet, neither a projected sales date or cost of the Nelson cube house has been set, nor has one of the homes actually been built. But in a few years, when the last major product we all use—the home—is fully adapted to factory production, we may all enjoy comfort in cubes.



5 To wall-in the cube, a variety of interchangeable panels would be available—containing doors, windows, closets and other storage facilities.

These drawings show the major steps in setting up a cube house. (A) After room arrangement is decided on, the aluminum foundation cones are laid out in their proper locations. (B) Screw-jack posts and floor structures are mounted onto the cones. (C) The cube's framework of posts and beams are assembled over the floor panels. (D) The extender units and dome roofs are attached to the cage to enclose the house.



MAIL PLANE TO BE LAUNCHED IN MID-AIR



Carrying a load of 20,500 pounds, mail and fuel, the small seaplane component of this composite aircraft will be launched in mid-air from top wing of the larger plane, after which the small plane will carry its mail cargo from England to America.

THE modern demand for long range flying at high cruising speeds has presented a take-off problem for highly loaded airplanes. As one solution to the problem, Major Robert Mayo, of England, has designed a composite aircraft, which consists of a small, fast, heavily-loaded seaplane mounted atop a huge, lightly loaded seaplane, the larger plane serving to carry the smaller one aloft to an altitude of about 10,000 feet before launching it.

The powerful four-engined lower component of the Mayo Composite Aircraft, as the novel craft is officially named, is equipped with a special strut-type structure to which the smaller, but heavily loaded, seaplane is firmly attached. Until the actual planned separation of the two aircraft has been made in mid-air, the controls of the smaller plane are locked to prevent a premature launching.

The combined wing area of the small and large seaplanes enables a take-off to be made from the water with a minimum run. Use of the larger seaplane as the launching medium enables the smaller plane to be loaded to its maximum of 20,500 pounds (mail, cargo and fuel), providing a cruising range of about

3,800 miles at 180 m.p.h., which will enable the mail carrying plane to fly non-stop from Southampton, England, to New York, N. Y. Trial flights of the composite aircraft are now being conducted and on the cover of this issue a MODERN MECHANIX artist has depicted the aerial launching as it will appear to observers.

Metal Table Folds, Tilts Top

WEIGHING only 8½ pounds, a newly developed adjustable table features a top that can be suspended over a bed or chair directly in front of the user. The top can be tilted to any angle as shown below, and its height is adjustable to any point from 25 to 42 inches above the floor. The table is built of metal and can be folded so that it occupies space no larger than its 21x16-inch top.



AT LAST—a Convertible

A STARTLING new vehicle which may be used in the air as a fast, sturdy airplane, and on the ground as a speedy, comfortable two-passenger coupe car, will shortly be available to aviation enthusiasts. The craft is really a streamlined mid-wing monoplane of 30-foot wing span, propelled by a 125-horsepower air cooled motor of regulation aircraft type. For ground use the ship may be quickly converted into a streamline car, simply by removing the wings and the rear end of the fuselage, leaving the closed cabin body resting on its three wheels, ready to drive through the streets. This transformation occupies about 20 minutes, by means of quickly detachable joints.

The development of the "Ascender," as the new ship is called, has taken many months of painstaking work in the selfsame Engineering Department which produced the fastest airplane in the world, Doolittle's "Flying Silo" which set a new world's record of 296 m.p.h. at the Cleveland air races last fall. The first Ascender has already been built and flown enough to prove itself a most unusual craft both in the air and on the ground.

Control of this craft, in the air and on

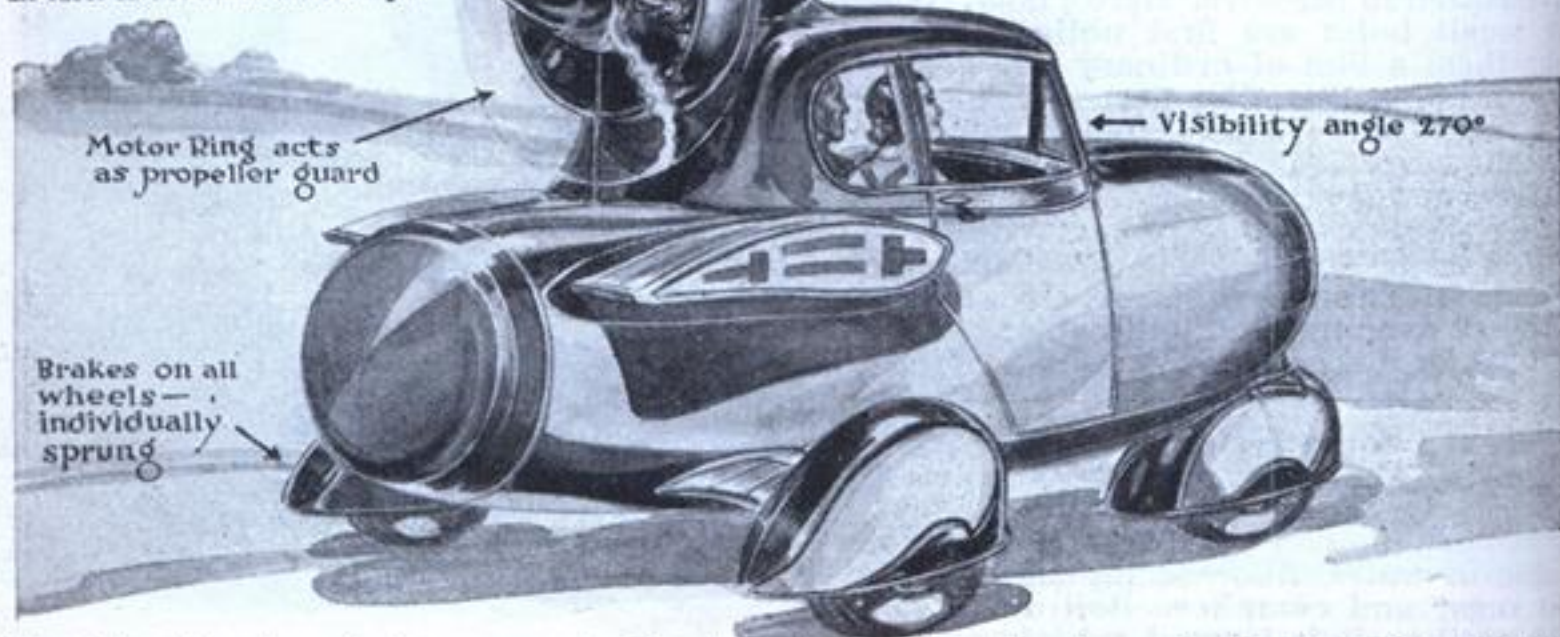
the ground, is by an automobile type steering wheel, a foot accelerator, and hand and foot operated brakes which act on all three wheels. While on the ground the ship rests on a three wheel landing gear, each wheel of which is equipped with internal brake and hydraulic shock absorber, as well as a large airwheel tire. The front wheel is steerable with the rudder of the ship, so that when the pilot moves the steering wheel to right or left, either on the ground or in the air, he guides the direction of his craft as he would a motor car.

On the takeoff there is no necessity of getting the tail up and balancing on two wheels while steering the ship down the runway by means of a rudder bar, as one is obliged to do in piloting the ordinary airplane. In this new craft, one merely sits behind the wheel, opens the throttle, and drives the ship down the field or runway as one would a car, with no possibility of "nosing over" even if brakes are applied suddenly, or from obstructions such as bumps, ditches, or soft spots. When sufficient speed has been attained the driver has merely to pull the wheel slightly toward him, whereupon the front wheel leaves the ground and the ship "takes the air."

Landing the Ascender is a simpler task than in the ordinary airplane. It is no longer necessary for the pilot to judge his speed and distance so that the ship will stop flying directly over the spot in the field where he wishes to land. With this craft, he need merely throttle the engine, point the nose down until the ship assumes a normal glide toward the field and set the ship onto the ground at a speed much greater than is safely possible in the ordinary airplane. As soon as the two rear wheels touch the ground, the front one is forced down, and brakes may be immediately applied to bring the ship to a smooth stop.

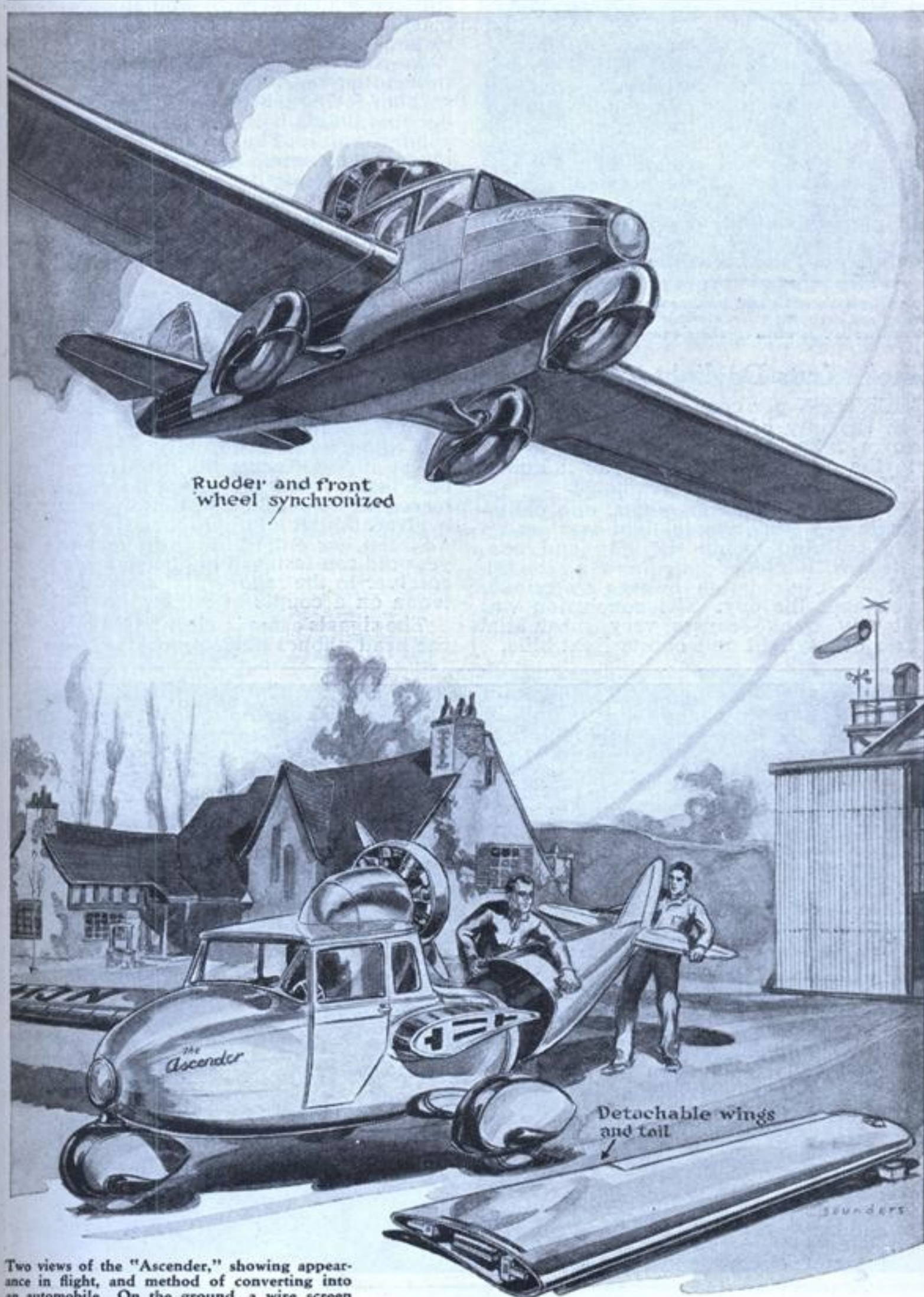


The convertible airplane-auto has been designed by the makers of this famous Gee-Bee type sport-plane which won the Cleveland air races last summer at 296 mph.



The airplane is made ready for street use in 20 minutes by removing the wings and tail unit, easily detachable. Note the location of motor where it serves equally well for ground or air use. Angle of visibility is exceptionally broad.

AUTO-PLANE *by* THEODORE A. HODGDON



Two views of the "Ascender," showing appearance in flight, and method of converting into an automobile. On the ground, a wire screen is usually employed around the propeller as a safeguard, though the arc of the blade is well within the confines of the car.

Jap Pilots Ride to DEATH

The current conflict between Japan and China has brought out an amazing revelation of the methods by which Japanese pilots assure air bombs reaching their target by putting a man inside to steer them. Why? Read the reasons in this article, and you'll have a better understanding of Japanese psychology toward the machines of war.

IMAGINE yourself strapped within a hot-low chamber inside a huge air bomb, surrounded on all sides by high explosives. In front of you is an airplane type rudder which steers the tail unit of the bomb. Windows in the nose enable you to see ahead.

You're loaded into the bomb, which is placed in its nest under the fuselage of a bombing plane. The bomber takes off, soars above a target—say, an ammunition dump of the enemy. Up above you, the pilot of the plane pulls a lever.

Down you go, plunging toward the ground with terrific speed. You see that you aren't going to strike the ammunition dump, but will land many yards to one side of it. So you twist the control rudder, swerving the bomb's course. Success! The dump looms up directly below the windows

of your bomb. And that is practically the end of things for you.

Sounds like the superheated imagining of a Jules Verne, doesn't it—the sort of absurdity that a sensible man would laugh off as being unheard of, an astounding, amusing impossibility?

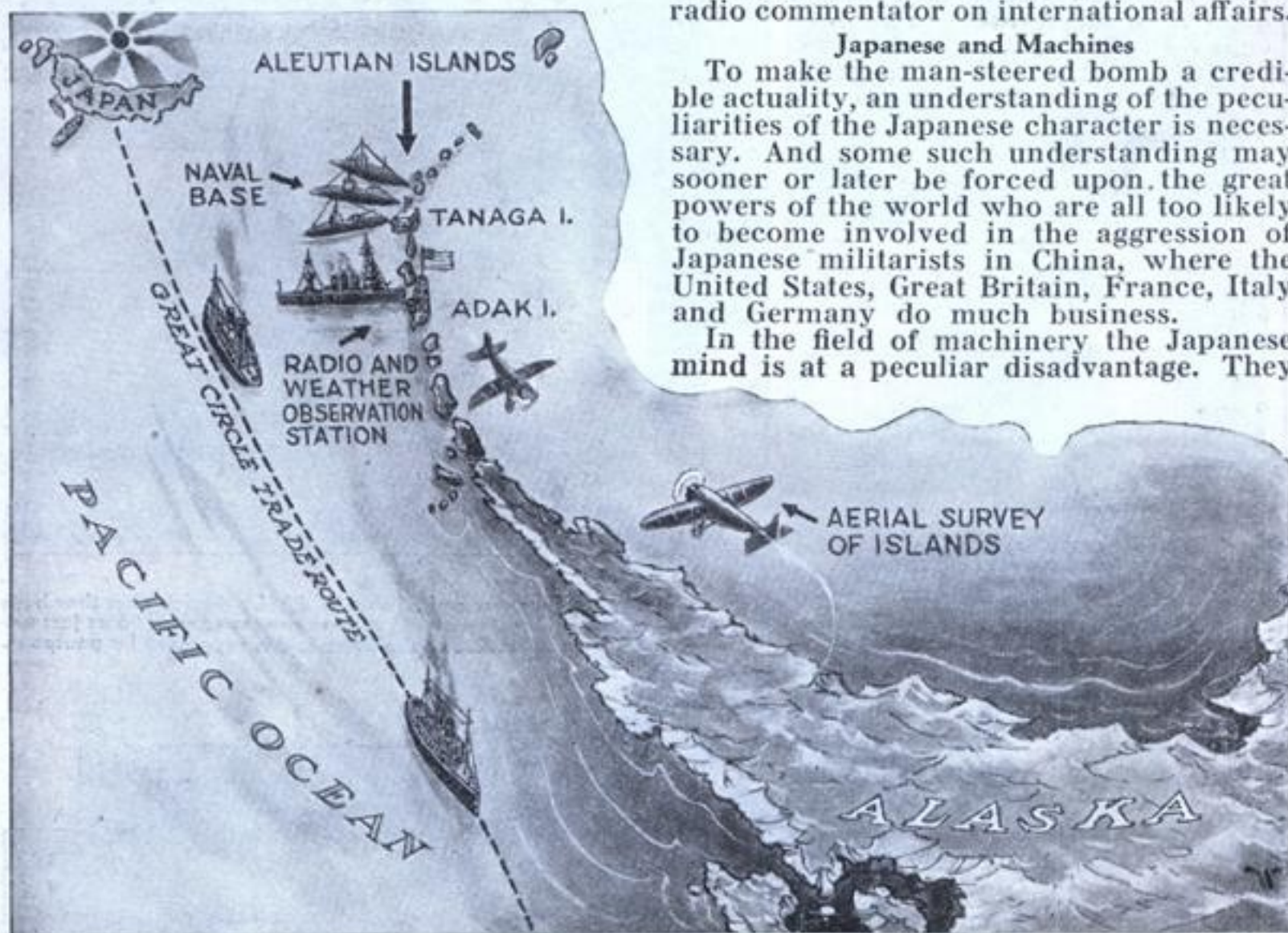
It's nothing of the sort. It's an actual fact of warfare, a method used by Japanese pilots who deem it an honor transcending all others to ride to glory for the mother country. They know that their memory and their families will be forever honored in their homeland.

Rumors of the flying bomb death ride have filtered out of the conflict now being waged by the Japanese and Chinese. Necessarily this information has been of a confidential, undercover nature, but not long ago it was given nation-wide publicity by a radio commentator on international affairs.

Japanese and Machines

To make the man-steered bomb a credible actuality, an understanding of the peculiarities of the Japanese character is necessary. And some such understanding may sooner or later be forced upon the great powers of the world who are all too likely to become involved in the aggression of Japanese militarists in China, where the United States, Great Britain, France, Italy and Germany do much business.

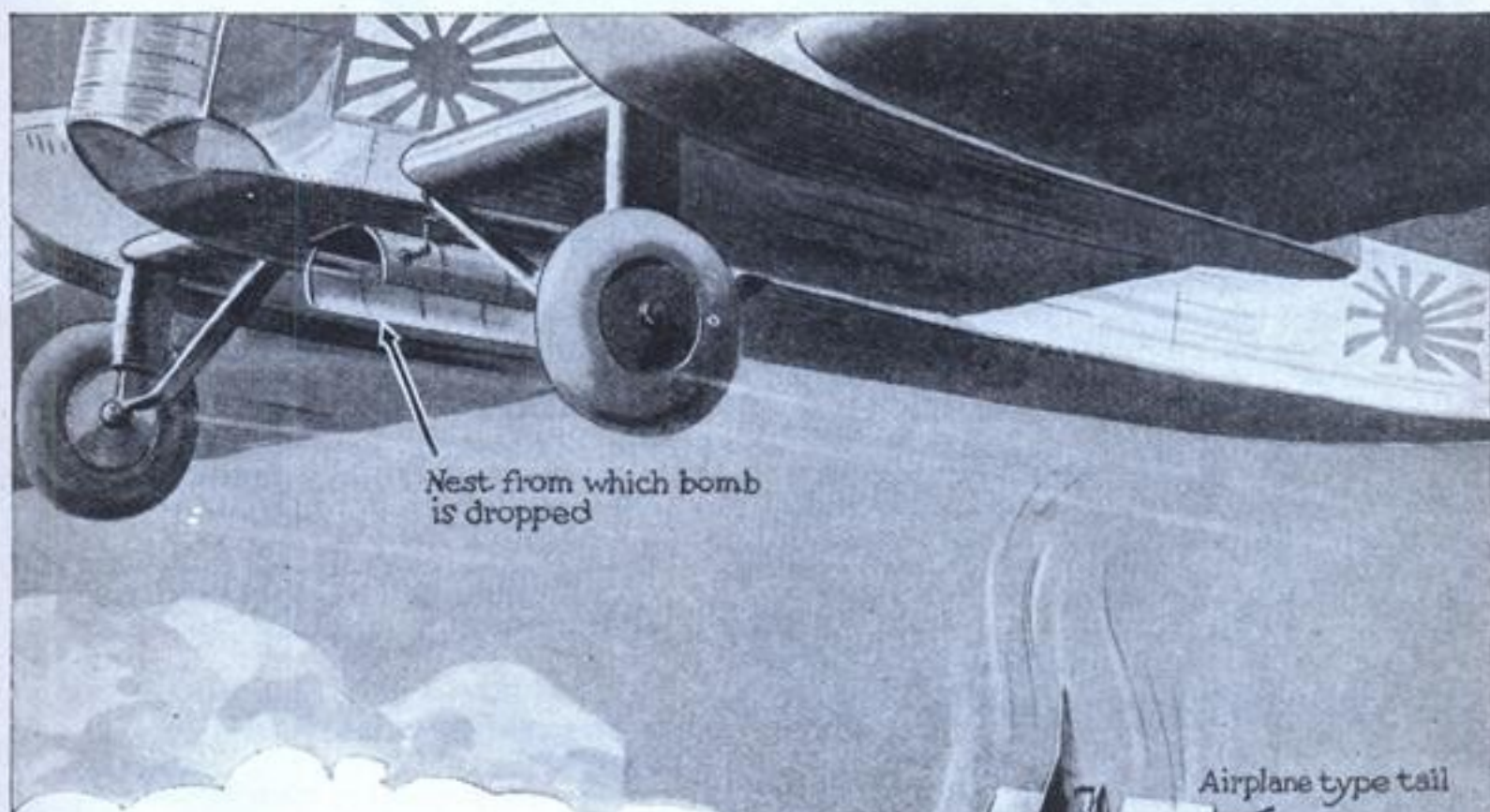
In the field of machinery the Japanese mind is at a peculiar disadvantage. They



Where the U. S. government expedition is now conducting a survey of the Aleutian islands, looking toward the possibility of establishing weather station, air base, naval base and possible fortifications. Note the proximity of the islands to Japan and the great circle course of steamers. Planes are being taken with which to make an aerial survey of the islands.

on Flying BOMBS

by RAY
HOLT



are able to turn out an exact copy of any mechanism that comes into their hands, but the type of mechanical imagination which went into its original creation—which, for want of a better term, is sometimes known as Yankee ingenuity—they are at a loss to duplicate.

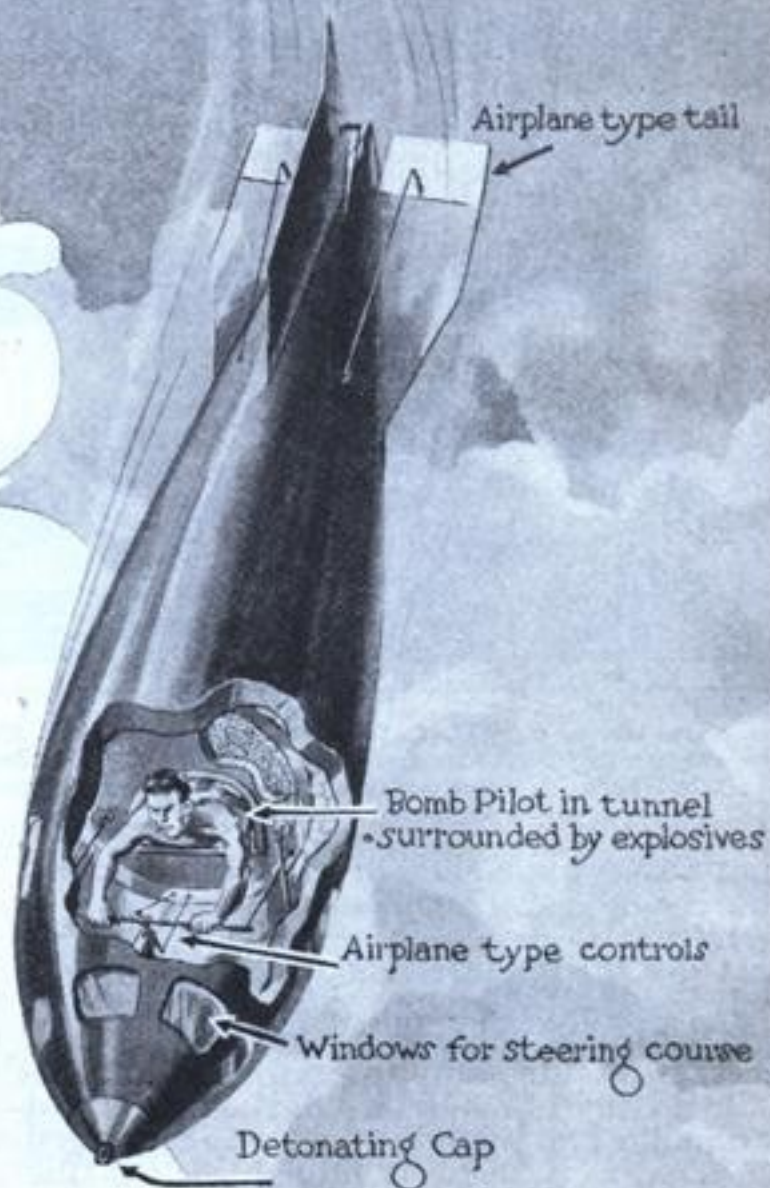
The simple truth of the matter is that a man is practically required to steer Japanese bombs to their mark because they haven't been able to develop the bomb-sighting machinery which makes Uncle Sam's flyers, for instance, so deadly in their accuracy.

Peculiar Oriental Psychology

As to why Japanese soldiers fight among themselves for the honor of being the bomb pilot who can look forward to being blown to certain oblivion, that's a matter of psychology not so easy to understand. Patriotism rules the Japanese to an almost fanatical degree, and love of country is so bound up with religion—the emperor being regarded as an incarnate god—that to be blown up in a bomb to further the successes of Nippon becomes something to be desired above all things.

When one understands the popularity that hara-kiri, a form of suicide by self-disembowelment, has had among the Japanese for centuries, the national willingness to dive to death in a bomb, or in any other way, becomes credible.

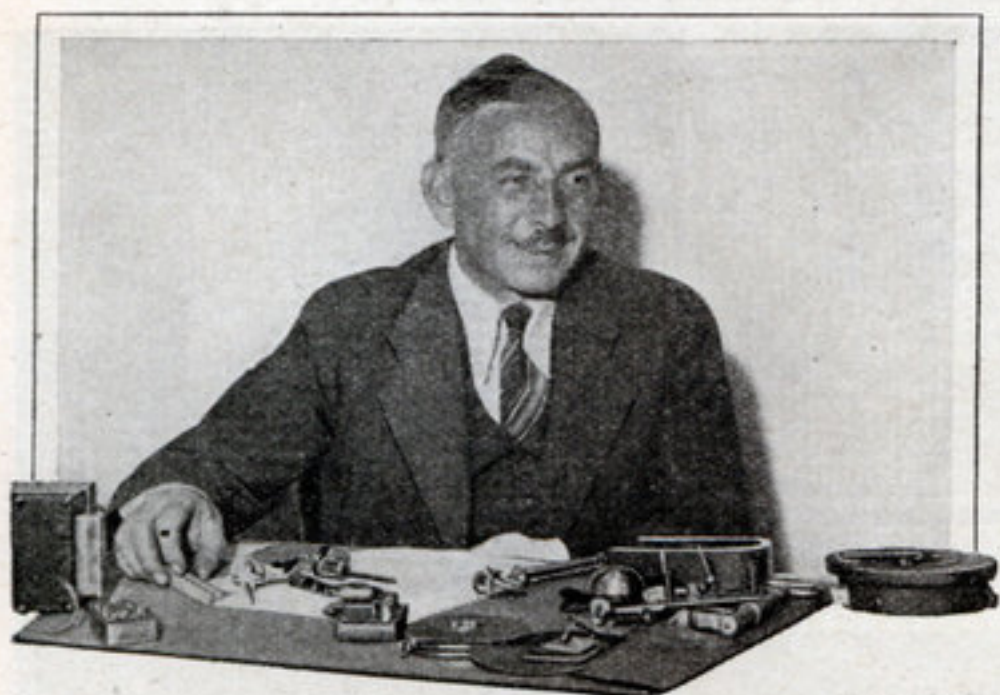
Hara-kiri, as formerly practiced, was



Riding to glory for the mother land, a Japanese pilot inside a bomb dropped from an airplane steers it to destruction because Japanese mechanics are unable to design elaborate sighting devices which would assure reasonable accuracy.

DEPRESSION Spurs Lost

by BENNETT LINCOLN



Charles Courtney, master locksmith, who recovered part of the sunken gold of the Hampshire. He tells of his adventures in this article.

GOLD, down through the ages a symbol of wealth, has now become so doubly priceless that we in this country may not even legally possess it! Beyond a doubt that is one reason why so many expeditions are at work today recovering the gold of other ages—gold which went down weeks or years or centuries ago, and since that time has been resting uselessly in the mud-filled hulks of ancient galleons.

Just how many submarine treasure-hunting expeditions are at work today it is impossible to say, since many of them surround their activities with a veil of absolute secrecy. The purpose which this secrecy serves is easily understood when one realizes that the treasure lure may bring rival

salvors to the scene ready to do battle for sunken loot.

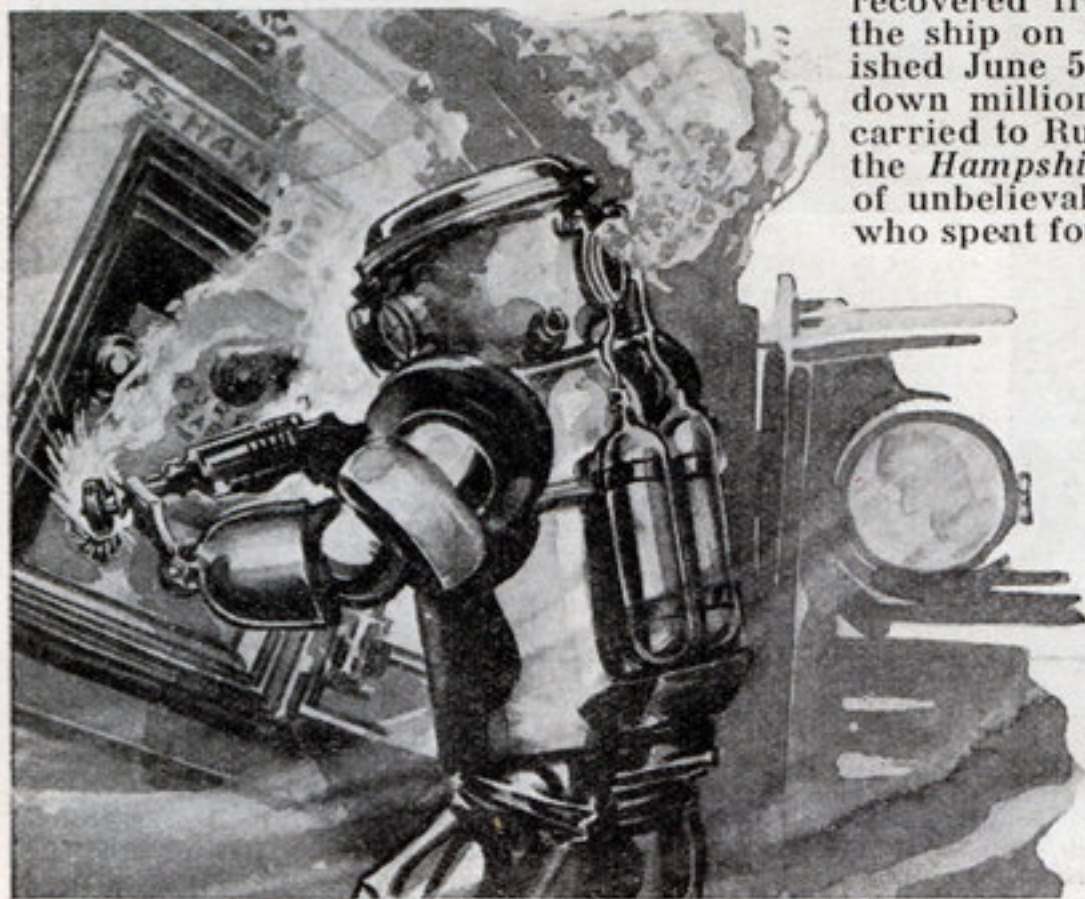
A few days ago a coast guard cutter was despatched to a point 60 miles off the Virginia Capes where two rival treasure ships were threatening open conflict. The lure in this case was the sunken *Merida*, which went down 20 years ago after a collision, carrying a reputed \$6,000,000 in gold.

The trawler *Theresa and Dan* and the tugboat *Salvor* were both anchored in the vicinity of the sunken ship. Each called for assistance to prevent an open clash. Eventually both ships retired and the *Merida's* gold still remains for the lucky salvor.

Perhaps the most striking of recent hunts for lost ships is that in which \$60,000 was recovered from the sunken *Hampshire*, the ship on which Lord Kitchener perished June 5, 1916. With the boat went down millions in gold which was being carried to Russia. Just how the wreck of the *Hampshire* was located in the face of unbelievable difficulties by a "Mr. X" who spent four years tracing down a German who worked on the boat which left the mine that sank the *Hampshire*, is a story in itself.

More thrilling were the adventures of Charles Courtney, master locksmith, who personally recovered a strong box from the *Hampshire's* safe containing \$60,000. Readers of MODERN MECHANIX AND INVENTIONS

At left—Courtney bored open the sunken Hampshire safe with a grindstone drill and removed a strongbox containing \$60,000 in gold. He had to work with extreme care to avoid setting off possible T.N.T. triggers within the safe.



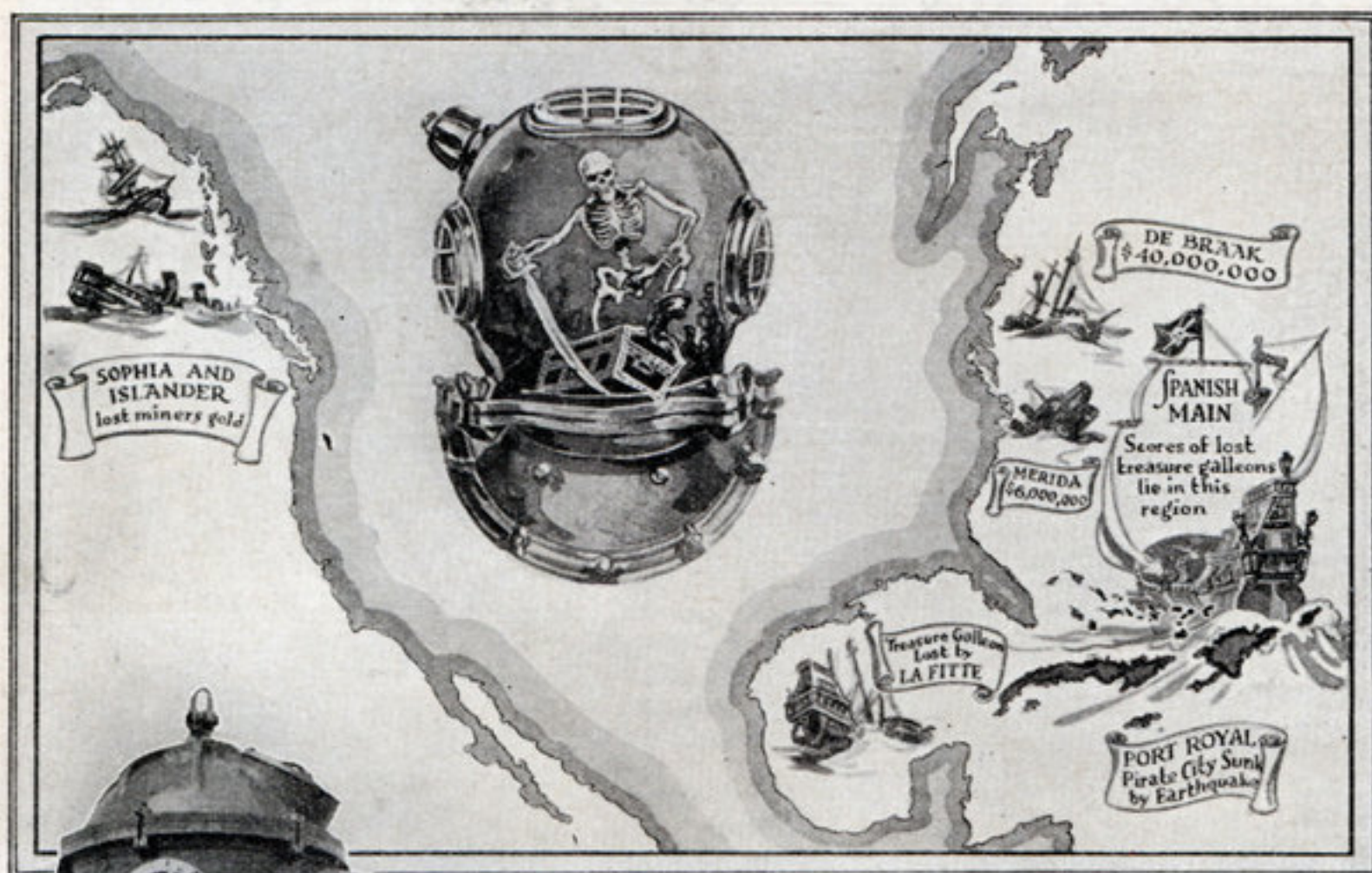
Gold TREASURE Hunts



Charles Courtney's long battle with death when treacherous currents crushed him irresistibly against the bulk of the sunken treasure ship, is illustrated. In circle—how telephone communication is maintained. Map shows sunken Hampshire.

Inventions for August

Treasure Wrecks Dot Shores of Our Continent—Many Still Unfound



Some of the wrecked treasure ships of the American continent are pointed out on this map. These are only those which have been definitely located and on which salvage work has been done. Scores of others lie in spots as yet unknown, waiting to be found through old records—just as the location of the De Braak with its fabulous \$40,000,000 in gold was recently discovered after long search.

Hampshire, Mr. X came from the other side of the sea to seek his services. Courtney accepted the commission, veiled in secrecy, little knowing that before he had completed his contract he would very nearly have paid with his life, and that he would carry a shattered wrist and hair prematurely whitened by terror as a permanent reminder of a disastrous bout with death.

Sitting in his New York office, the master locksmith told me the terrifying story of his experiences for readers of this magazine. He told me of being taken aboard the salvage ship, of a zig-zag course taken to the treasure site to elude possible pursuers, of the location of the wreck—and finally of his own part in the drama.

"Right after the ship was identified, I started my diving work. I went down and with the use of a grindstone drill succeeded in boring open a built-in safe in the ship. That was a mighty difficult job, cracking that safe. I had to guard against T-N-T triggers or other safeguards which its makers might have secreted in it. I blew it open without mishap, however, and withdrew from it a strong box which I later discovered contained about \$60,000 in gold.

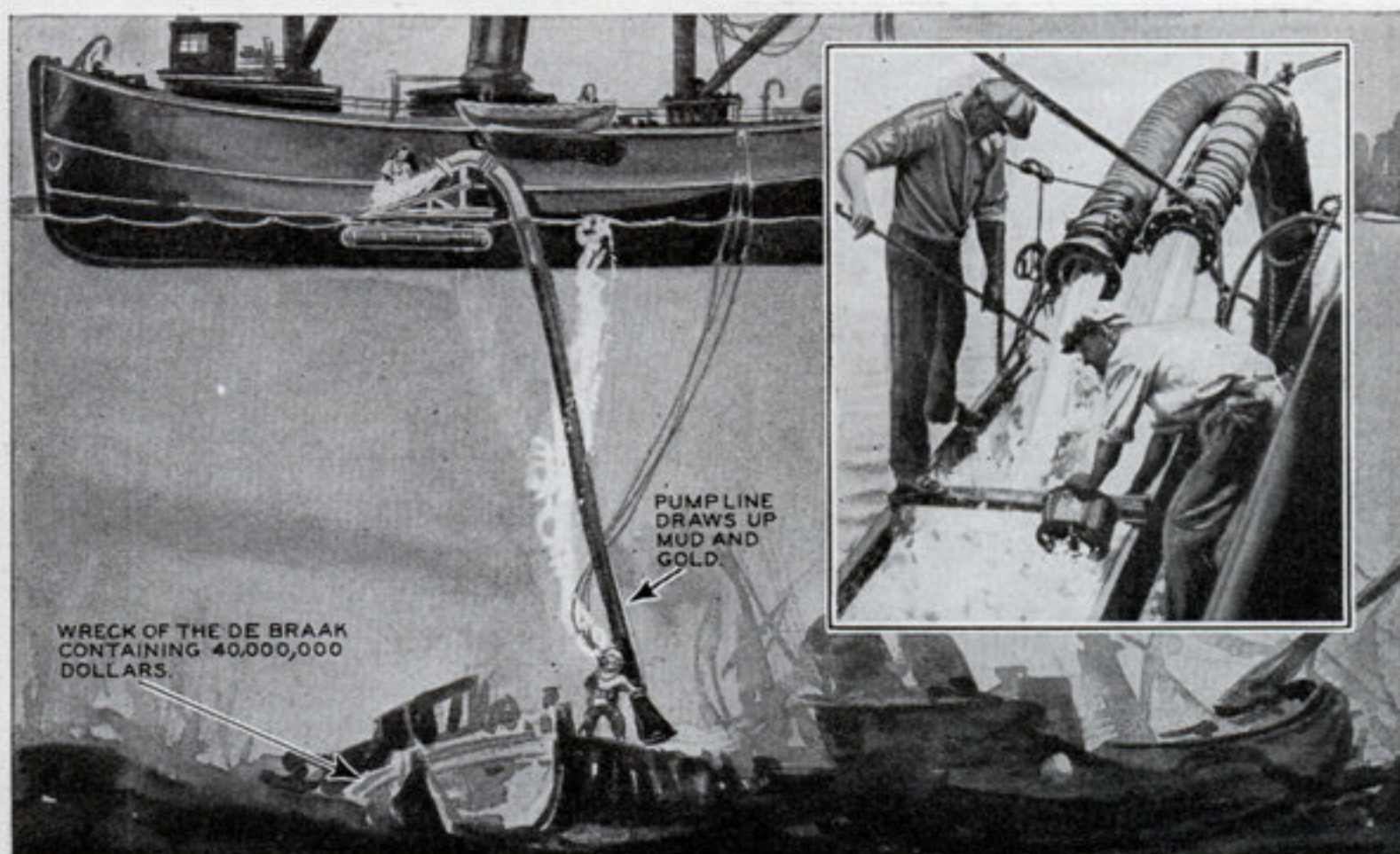
"I went down once again after recovering that strong box with the \$60,000. You see there was no possible way of opening those safes without my presence down there. It was impossible to calculate the nature of the tumblers because of the havoc

Brand new diving apparatus, suitable for treasure salvaging, just tested by British officials. Air supply is carried on back of the suit, making air lines to surface unnecessary. Limb joints move flexibly on an oil cushion.

will remember Mr. Courtney's own story of his methods of opening the safe on the sunken *Egypt* in an eminently successful salvage venture which up to date has recovered \$3,250,000.

Mr. Courtney is president of the American Association of Master Locksmiths, and so widespread is his fame that when a man was needed to unlock the safes of the

Long Lost De Braak, Carrying \$40,000,000, Found After Long Search



The De Braak, sunk off Cape Henlopen, Delaware, decades ago, is a hulk reputed to contain \$40,000,000 in gold. It has just been located by Allan C. Robertson after a long, romantic search through records of the period. Salvaging will be done by pumplines, sucking up mud and cleaning the "bones" of the hulk to make it easy for divers to lay hands on the drowned gold. Inset photo shows the powerful pumplines being tested. The photo at right shows weird machine used by syndicate to recover gold from the *Islander*, sunk off Alaska. Some gold was recovered when dissension among members forced temporary abandonment of scheme.

of time. The only method we could employ was to locate the safes and figure out the best and most harmless way of blasting them open, and still regain the treasures they held.

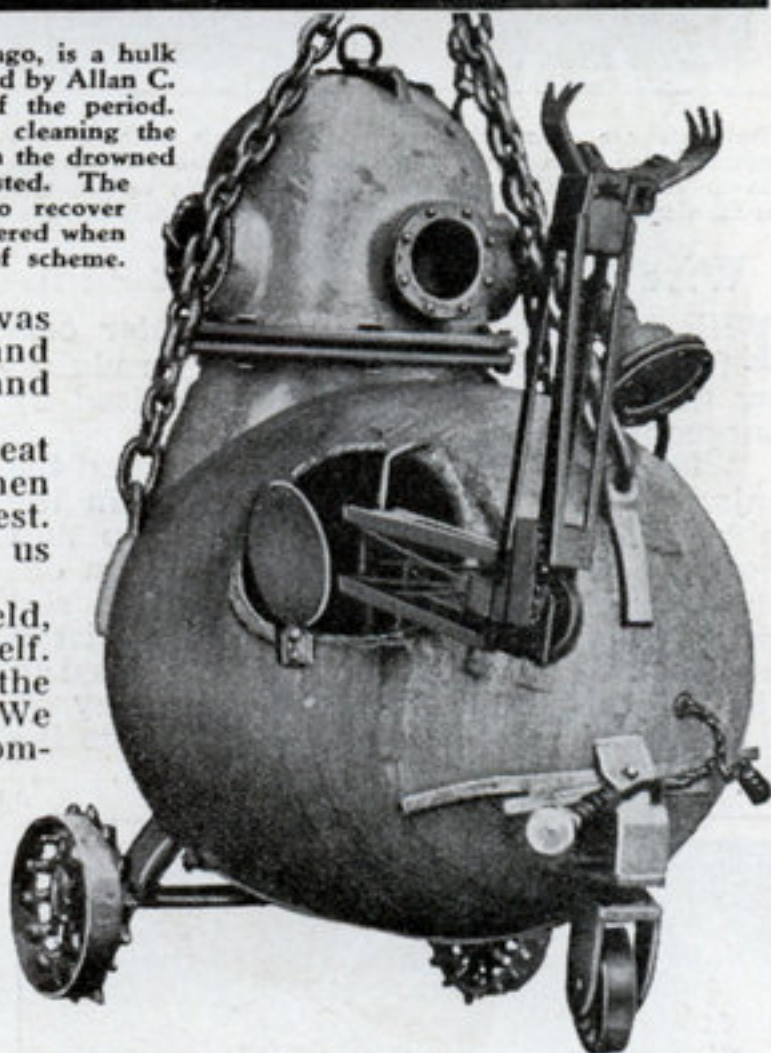
"By April 24 there had already been a great deal of blasting work. This was the day when we were to reap our hard-fought for harvest. There was \$10,000,000 lying there waiting for us to bring it back to civilization.

"Down we went, Costello, Samuel Mansfield, an adventurous youth from Virginia, and myself. We were in our aluminum suits. We had the customary equipment and auxiliary devices. We used our telephones constantly, keeping in communication with the engineers on deck of the salvage boat. As my two companions and myself were let down on the second descent the first 100-foot drop was without a hitch. At 200 feet I was suddenly seized with misgivings. Something was wrong.

"I was cut off from communication with my other two comrades. Fear of darkness overcame me—darkness as smothering, as all-enveloping as the inside of a coffin.

"'Bring us up quick! We've been struck by an undertow!' I yelled desperately.

"But no response. No signal or other token that those on the surface got my S O S. Having had experience as a diver I tried to be calm. I figured, or tried to figure as calmly as I could, that those above were waiting for the current to ease. I

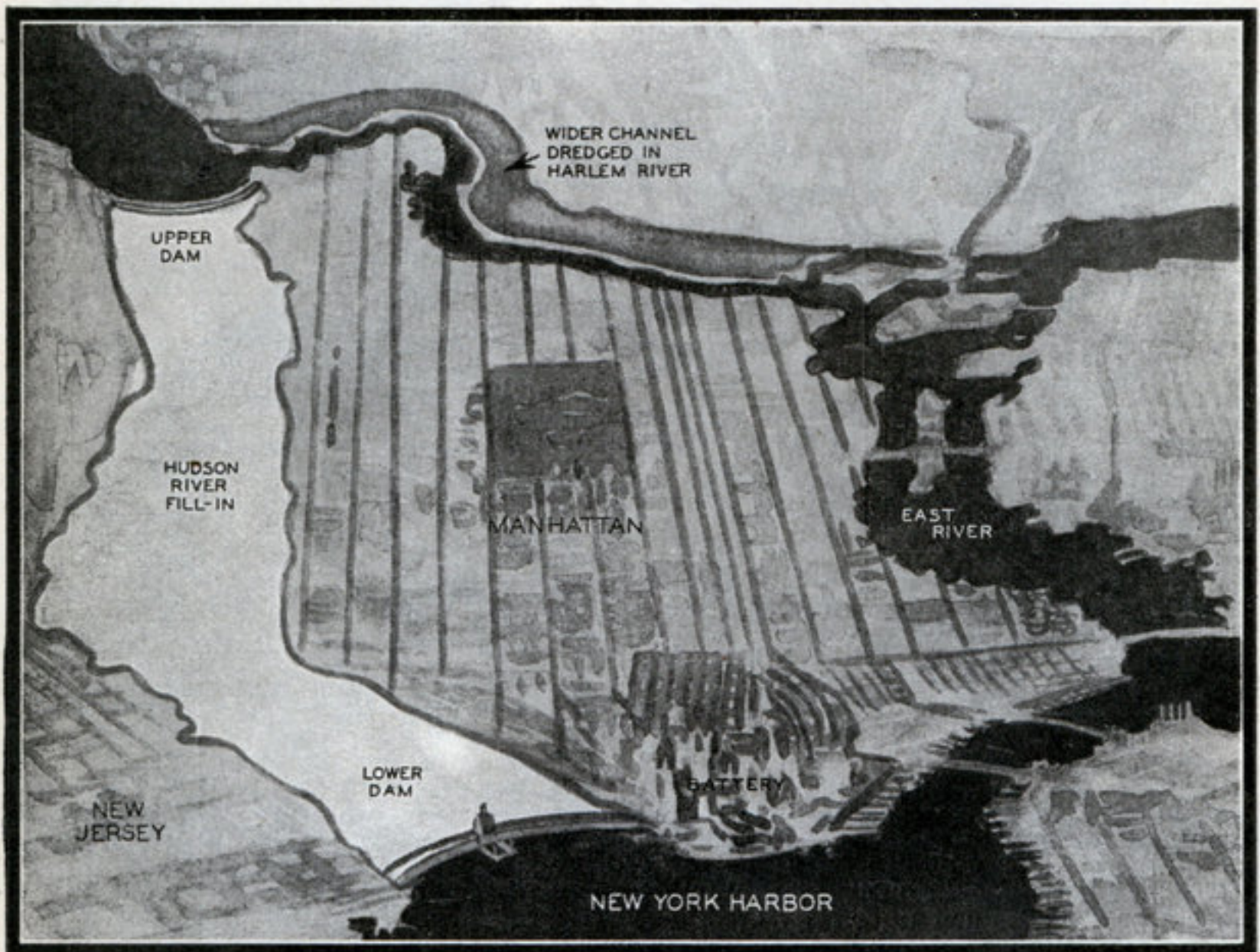


could not budge the cables. The electricity was cut off so that there could not be a short circuit.

"In another moment I was seized with a terrifying sensation. As I dangled there helplessly, hoping and praying for rescue, my suit was cut in the right side. I was flung violently against the side of the *Hamp*.

(Continued on page 8)

FILLING in the HUDSON



This map vividly tells the story of the plan to dam the Hudson river and rebuild New York, ending the isolation of Manhattan Island. Water which now finds an outlet through Hudson river would be diverted via widened Harlem river to the East river and then into outer harbor. What is now Manhattan Island would be grafted to New Jersey.

by ALFRED ALBELLI

PLUG up the Hudson river at both ends of Manhattan . . . divert that body of water into the Harlem river so that it might flow out into the East river and down to the Atlantic ocean . . . pump out the water from the area of the Hudson which has been dammed off . . . fill in that space . . . ultimately connecting the Island of Manhattan with the mainland of New Jersey . . . and you have the world's eighth wonder—the reconstruction of Manhattan!

That is the essence of the plan proposed by Norman Sper, noted publicist and engineering scholar. It is calculated to solve New York City's traffic and housing problems, which are threatening to devour the city's civilization like a Frankenstein monster.

In keeping with the Norman Sper plan, the ten square miles of land which would thereby be reclaimed from the Hudson would not only provide for thousands of additional buildings, but also for avenues and cross streets which would greatly re-

lieve the congestion in present thoroughfares.

Today there are ten avenues laid out along the length of Manhattan. These are crossed by 125 streets. It is the lack of up-and-down arteries which has given rise to the existing traffic crisis. Sper would double the number of avenues.

Foundation for New Buildings

His suggestions go still further. No use waiting, he says, until the entire area is filled in before starting underground improvements. Build your tunnels, conduits, mail and automobile tubes, and other subterranean passages indispensable to comfort in the biggest city in the universe as you go along. Do it in the process of filling the basin left by the drawing off of the water.

"When every possible subterranean necessity had been anticipated and built," Sper points out, "a secondary fill would bring the level up to within twenty-five feet of the Manhattan street level.

"Upon this level would rest the foundations and basements of the buildings that would make up the new city above, planned

to REBUILD NEW YORK



Manhattan Island as it looks today from U.S.S. Macon. The lower dam, under Norman Sper's proposal, would start at the Battery, shown here, extend across Hudson to New Jersey shore. Reclamation of river bed would provide New York with ten square miles in which to expand. Necessity for expansion is graphically shown in this aerial photograph.

for fresh air, sunshine and beauty. Thus, below the street level would be a subterranean system of streets that would serve a double purpose. All heavy trucking would be confined to it, but primarily it would serve as a great military defense against gas attack in case of war, for in it would be room for practically the entire population of the city.

"If the Russians had the vision and the courage not only to build huge cities from the ground up, but to practically rebuild an empire, surely America should not be frightened at a project as big as this."

Cost One Billion Dollars

It would cost about one billion dollars to build, he figures.

If you think such a project is beyond the abilities of modern engineers, asserts Mr. Sper, think of these achievements:

The seemingly invincible Colorado river has been diverted to build the biggest dam in the world—Boulder dam. Fifty-foot tunnels were hewn out of the stubborn rock on either side of the river to make way for diversion of the water, which, in flood seasons, becomes a raging torrent.

Look at the engineering wonders accomplished in construction of bridges. The two bridges now being built across San Francisco bay, one over the Golden Gate and the other from San Francisco to

Oakland, defied problems which seemed unsurmountable even a few years ago.

Consider the success of Colonel George Goethels in finishing the Panama Canal and opening it to traffic of the world's largest ocean going vessels after others had failed.

That virtually closed Mr. Sper's case.

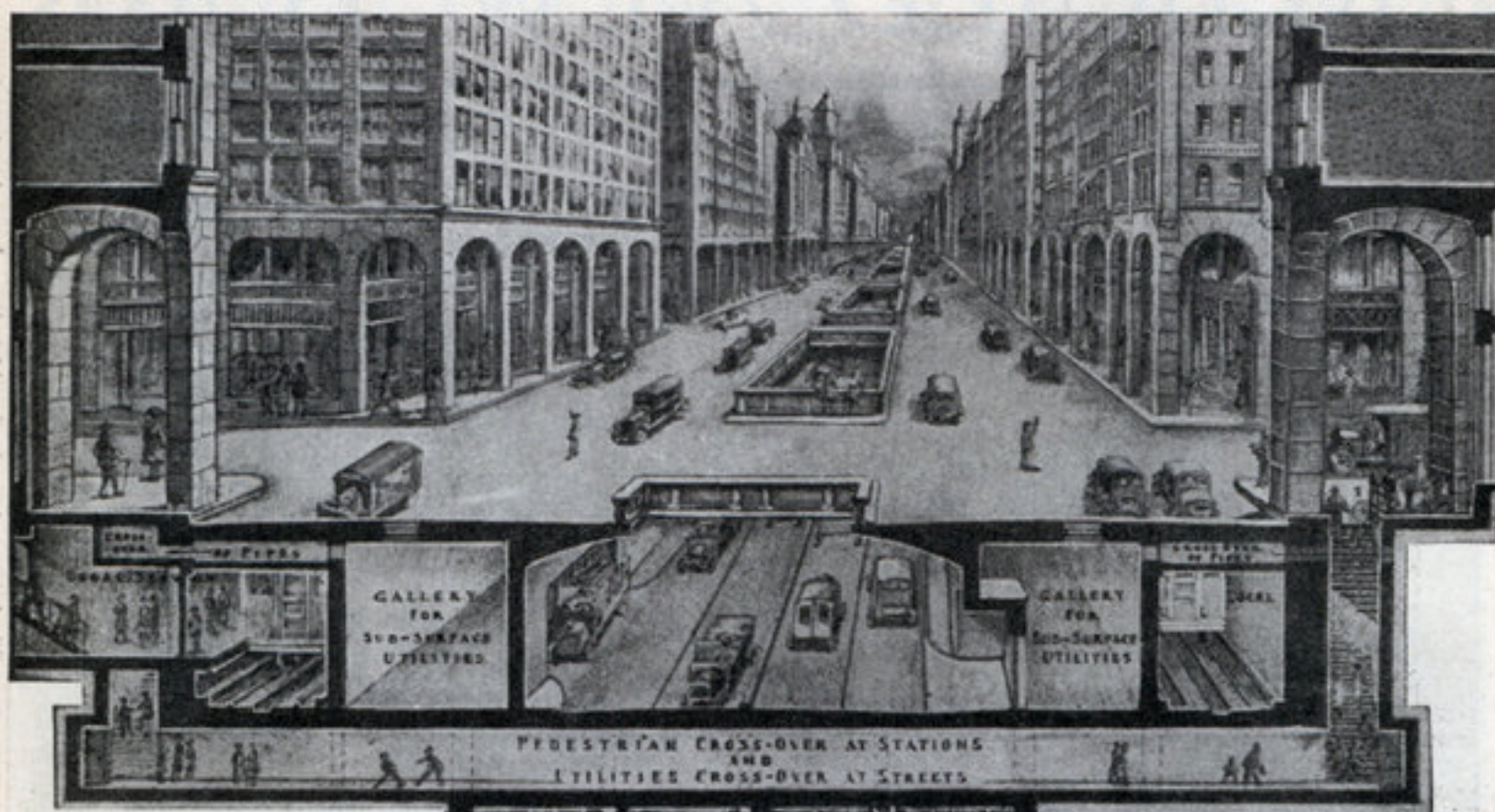
Engineers uniformly agree that there are very few problems which can successfully defy the determination of civilization to conquer.

As in many other instances, the project to dam the Hudson river and reclaim the river bed to provide New York with an additional ten square miles of land, would depend largely upon the ability of the government to finance such a project.

In the past, individual projects were considered in terms of millions of dollars and only recently in terms of hundreds of millions. Now comes Mr. Sper with a plan which must be considered in the light of a billion dollar expenditure. This single project would cost within approximately one-thirtieth of the total of the public debt of the United States government as it now stands.

While such a figure is enough to stagger an ordinary financial mind, engineers point to the fact that the project would provide an immediate income of almost unbelievable dimensions. For instance, the

Surface Traffic Would Be Placed Underground in Hudson River Bed



Here is how the proposed new section of Manhattan would look when finished. Buildings in normal fashion on the surface, with beautiful, wide streets and only casual, block to block vehicular traffic. Below you find the numerous automotive, pedestrian and rail tunnels, all well ventilated and all having easy access to the street above.



land reclaimed could be sold outright or leased for 99-year periods to private concerns or to individuals and because of the desirability of the location, would bring extremely high rentals or sales prices. Then, too, the franchises for electric and telegraph conduits, steam heat tubes, street car and railway tubes would bring in millions of dollars annually.

An annual income of a hundred million dollars a year would represent a return of ten per cent on the investment of a billion dollars and engineering experts all agree that this would be only a trifle of the amount that could be realized from this great project.

Thus, it is easy to comprehend the advisability of the Hudson river reclamation project from both an engineering and financial standpoint.

As a special investigator for MODERN MECHANIX AND INVENTIONS, I consulted with several eminent authorities in the field of engineering.

C. Keith Pevear, well-known Manhattan consulting engineer, who has been identified with various projects for municipal improvement said:

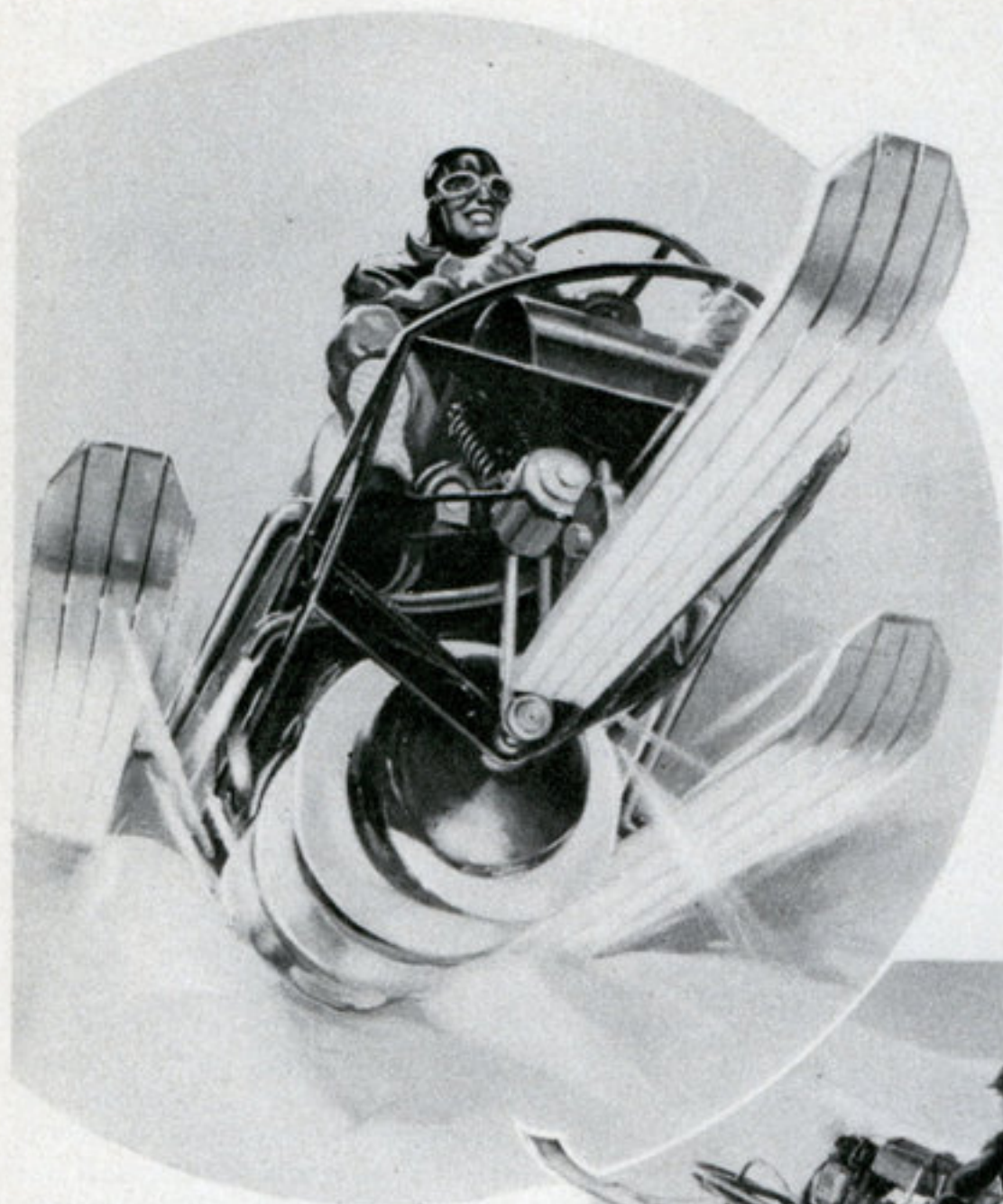
"I have conferred with several marine engineers on the plan you have told me about. After several hours of spirited discussion—for we actually became very much interested in the various phases presented

(Continued on page 118).

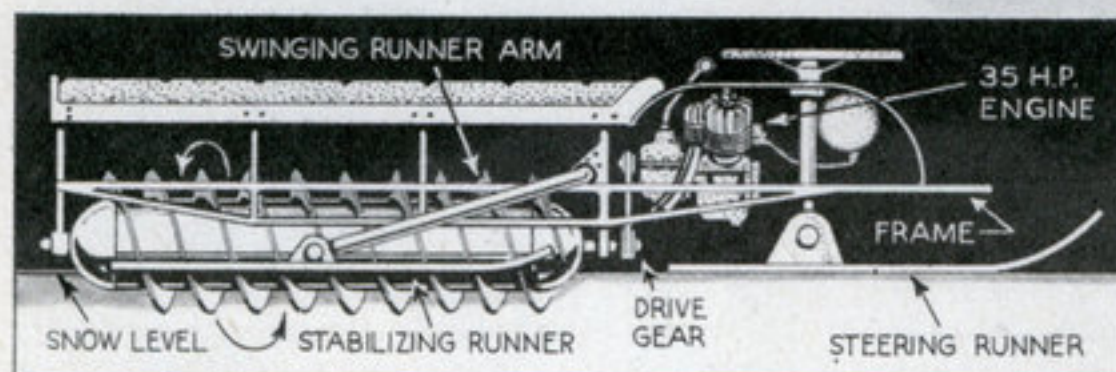


Is this the way New York of tomorrow will look? This is apart from Norman Sper's plan, but it fits right into the scheme, providing for a depressed four-lane roadway, forming part of a speedway from Manhattan Bridge to the Bronx. Park treatment of the remainder of the area would provide a magnificent 300-foot avenue in the present vacant blocks between Chrystie and Forsythe streets, from Manhattan Bridge at the foot of Second avenue.

HILL HOPPING A WORM DRIVE SLED



Added to the list of mechanical sports will be this worm drive ski-sled, already proven practical in recent tests in California. The artist shows ski-sled modified for jumping.



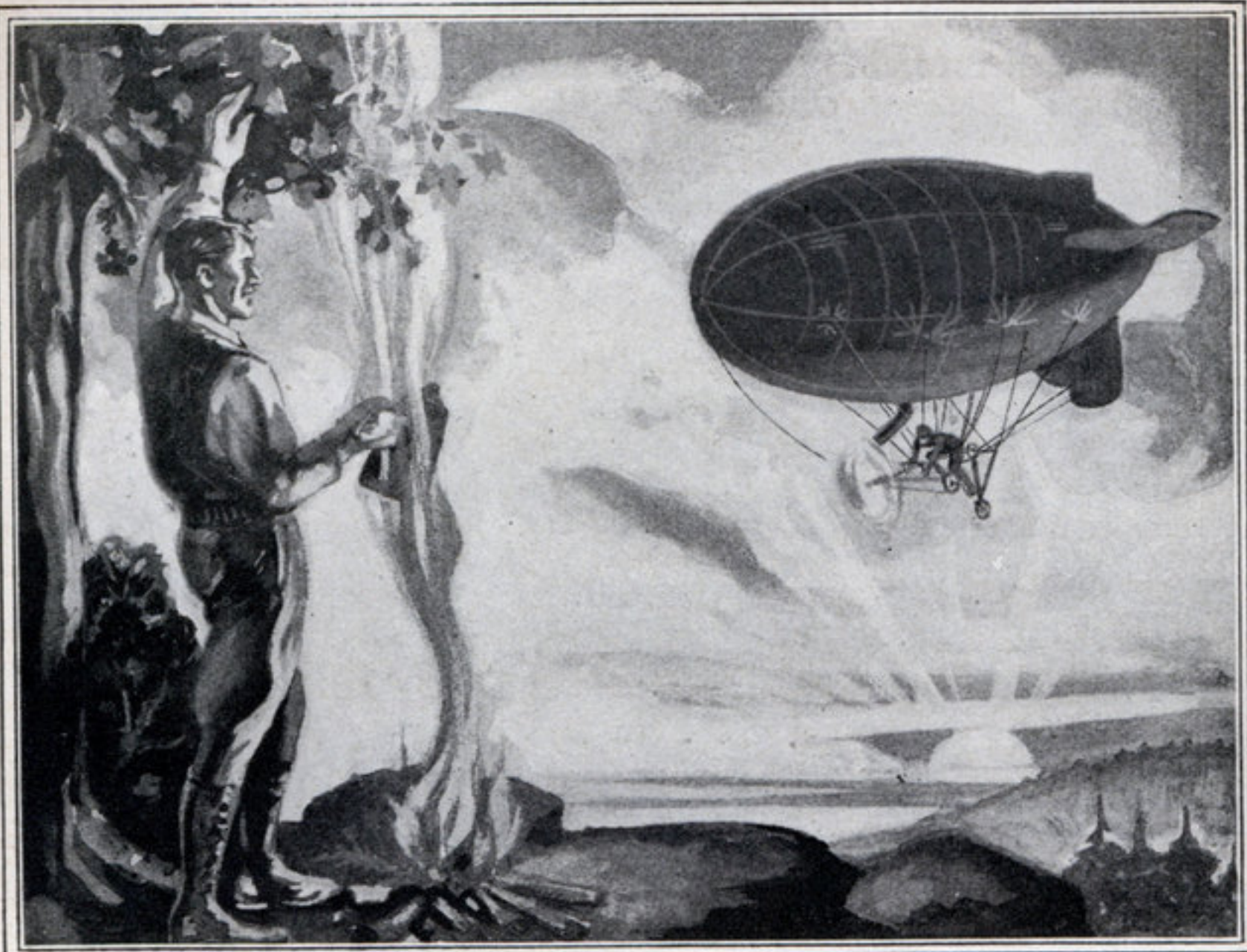
Here is the original model of the ski-sled as it began its ascent of Lassen Peak, 10,000 feet above. The worm drive sled made the difficult climb with ease. Left—A diagram showing the drive gear and runners.

FROM California comes a radical innovation in motor driven vehicles, a worm drive ski-sled. Powered by a 35 horsepower engine, it negotiates the steepest, roughest inclines with ease, and on level snowfields has attained speeds of twenty and more miles per hour.

With a more powerful motor, considerably higher speeds are expected, and the initial success of the experimental model may lead

to an entirely new sport in the form of motor ski racing and jumping. In order to achieve the latter sport, it will be necessary to mount the runners on shock struts, both to protect the worm-drive blades and the rider. This would be a simple matter.

More practical vistas opened by this novel sled lie in its adaption to the needs of Arctic exploration parties in their long treks over snowbound wastes.



One Man Bicycle Dirigible

A dirigible balloon, run by foot power with bicycle drive,
is being built by a Vermont inventor.

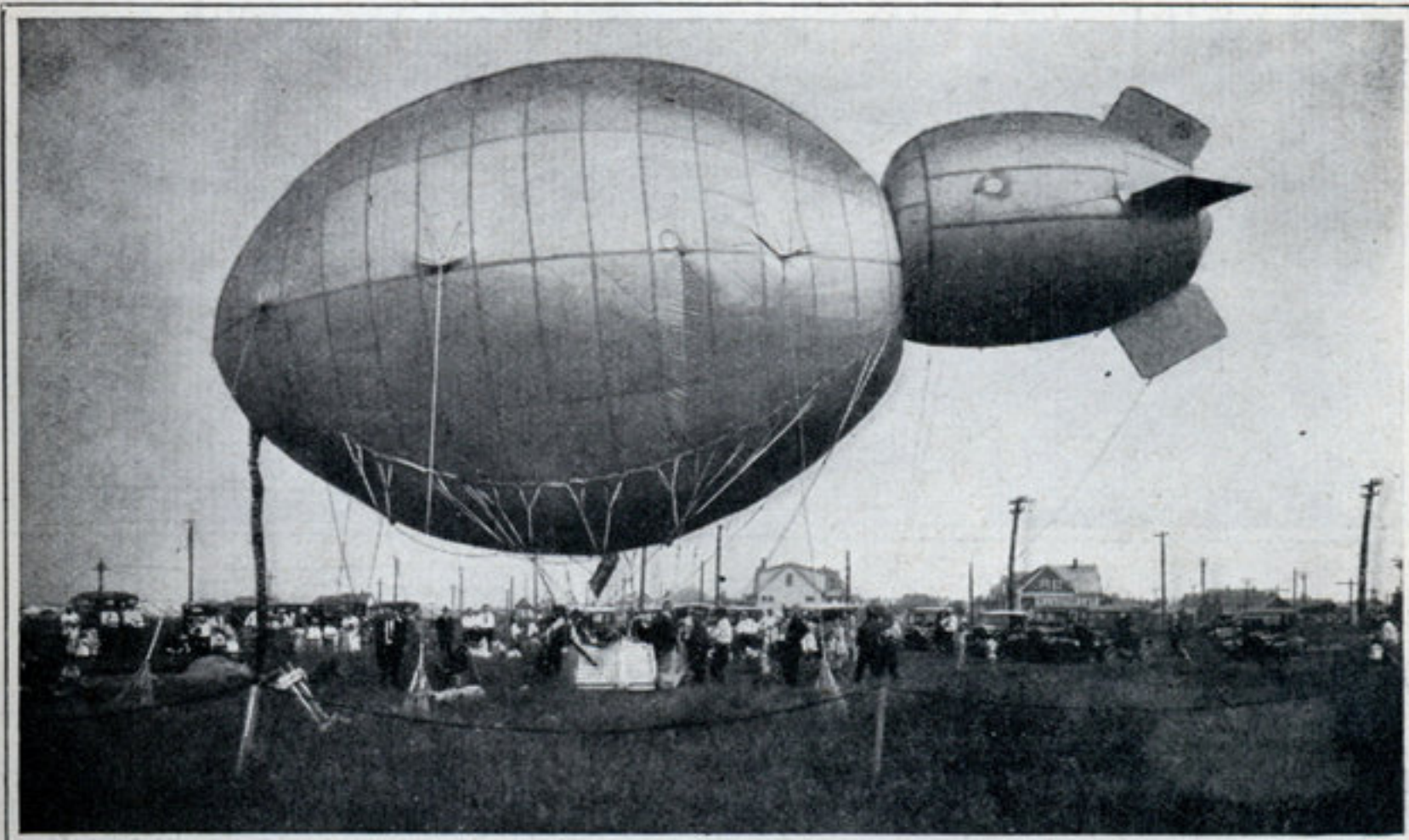
INTEREST in aviation is by no means exclusively confined to light airplanes, as is demonstrated by the number of letters contributed to *MODERN MECHANICS'* Shop Mail Box in which the writers inquire as to the possibility of constructing a small dirigible balloon which can be operated by man power. A dirigible powered with a bicycle, as depicted in the drawing above and as shown on the cover of the magazine this month, is under process of construction by Ray Fraser, of Brattleboro, Vermont.

As planned by Mr. Fraser, the bag of his balloon will be 30 feet long by 15 feet in diameter. The bicycle power plant is to be suspended beneath the bag, the pedals being connected by a chain drive to a propeller which, it is estimated, will drive the craft at a speed of about ten miles an hour. Steering rudders of the ship will be operated by

bicycle handlebars, while the elevators will be manipulated by a small wheel at the rear of the pilot's seat.

Although the idea of a tiny dirigible such as this is an appealing one, the item of cost will make such a ship impracticable for the amateur aeronaut. The bag must be filled with expensive gas and a suitable hangar must be erected to protect the ship from the weather. Furthermore, the cost of shaping the bag from rubberized fabric and attaching the working parts would run the initial cost of the dirigible to approximately \$10,000. The ship could be flown only in calm weather, since the 10 mile an hour speed would leave it helpless in a modest breeze. The addition of a motor would, of course, increase the speed, but it would also require an increase in the gas bag volume of at least fifty per cent.

Small Dirigible Powered With Motorcycle Engine; Lifts 500 Pounds

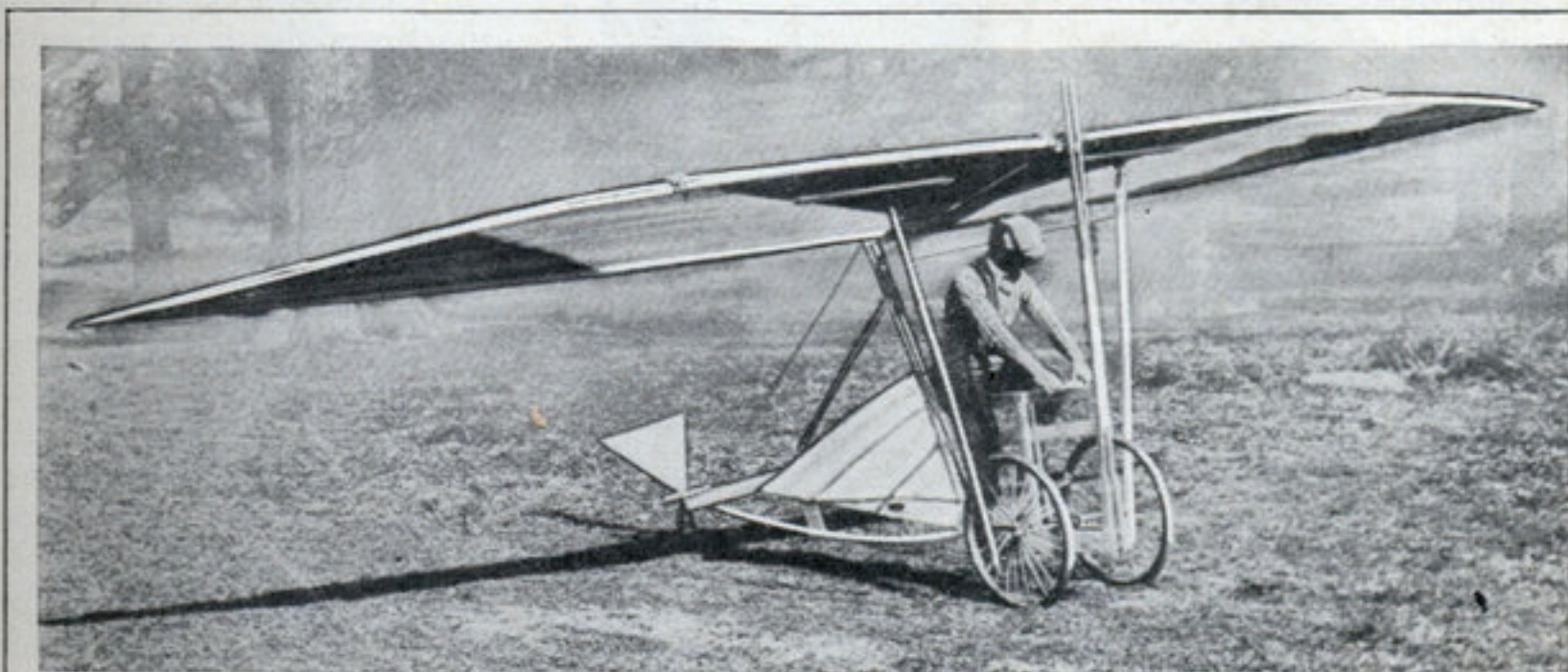


Note the unusual two-lobe construction of this tiniest of powered dirigibles, recently tested at Wright Field, Dayton, Ohio. The tail lobe is jointed so that it can be moved about to control the ship.

Mr. Fraser's inspiration for his bicycle balloon perhaps was derived from a study of the world's smallest dirigible, shown in the photo above. It is a unique ship of two lobes, the rear of which acts like a jointed tail which can be moved to steer the ship. A four cylinder Henderson motorcycle engine is used for power, developing a speed of 20 miles an hour. Designed by Matthew Q. Corbett, the unusual craft weighs only

800 pounds complete and can carry a useful load of 500 pounds.

Another aircraft which combines features of balloon and airplane is pictured below, the invention of E. Winter, of Fareham, England. It is a glider-like machine fitted with flapping wings which are intended to give it forward motion. Lifting power is supplied by a tank of hydrogen. Thus far, it has not been tested successfully.



This queer machine is a flapping-wing glider, operated by foot power, which is expected to ascend by the buoyancy of its hydrogen filled tank, which is the triangular white object under pilot's seat.

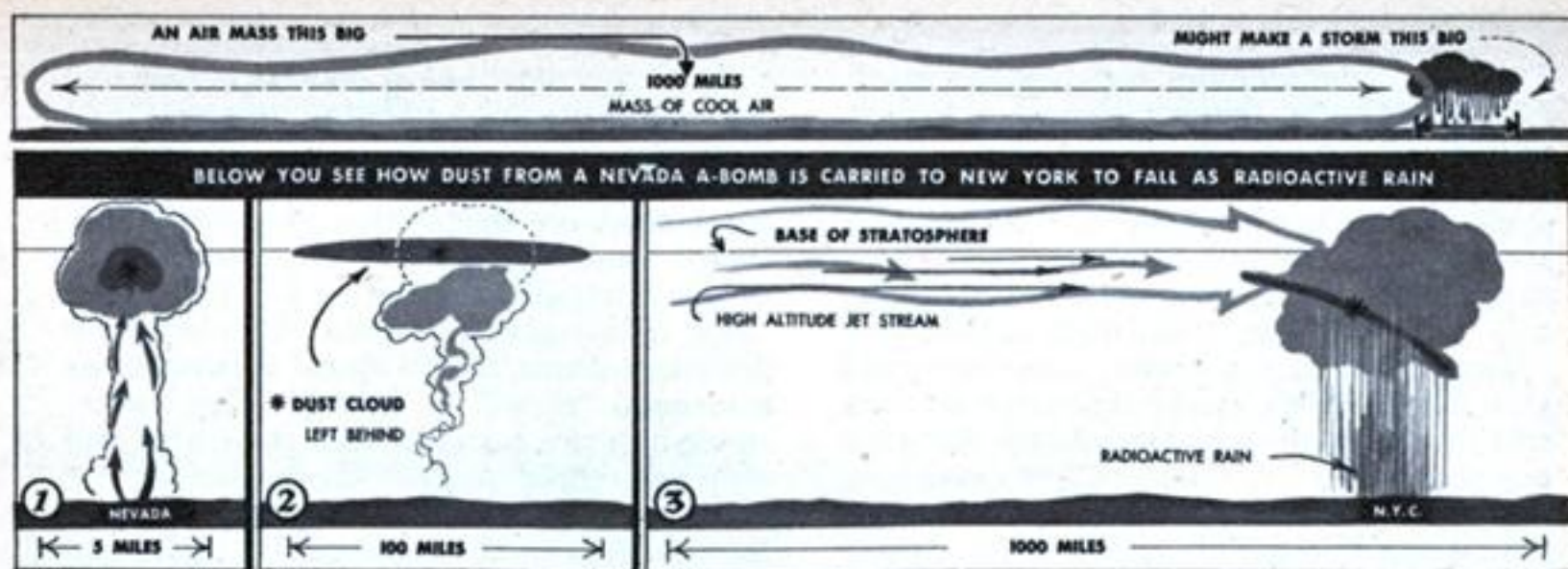
The Truth About...

Our Weather and the A-Bomb

Downtown section of Waco, Texas, looked like this after a twister ripped through it last May.



Many people, including weathermen, are inclined to believe that the atomic blasts are the cause of the vicious tornadoes, hurricanes, wind and rain storms that have swept across our country. MI Editors asked Eric Sloane, noted meteorologist, for his opinion. Here's what he has to say. . . .



THERE'S little doubt about our changing climate. The fierce winters of yesterday are disappearing, tornadoes and hurricanes are becoming more vicious and weather trends aren't "trends" any more. They can't be depended upon. Just about anything can happen—and does.

If you are one of the many who wonder if the A-bomb is responsible for our queer weather, you can forget it. It isn't so. What is the answer? It's simply that we are riding on the tail end of a glacial age and our climate is shifting.

Let's take a very simple proof.

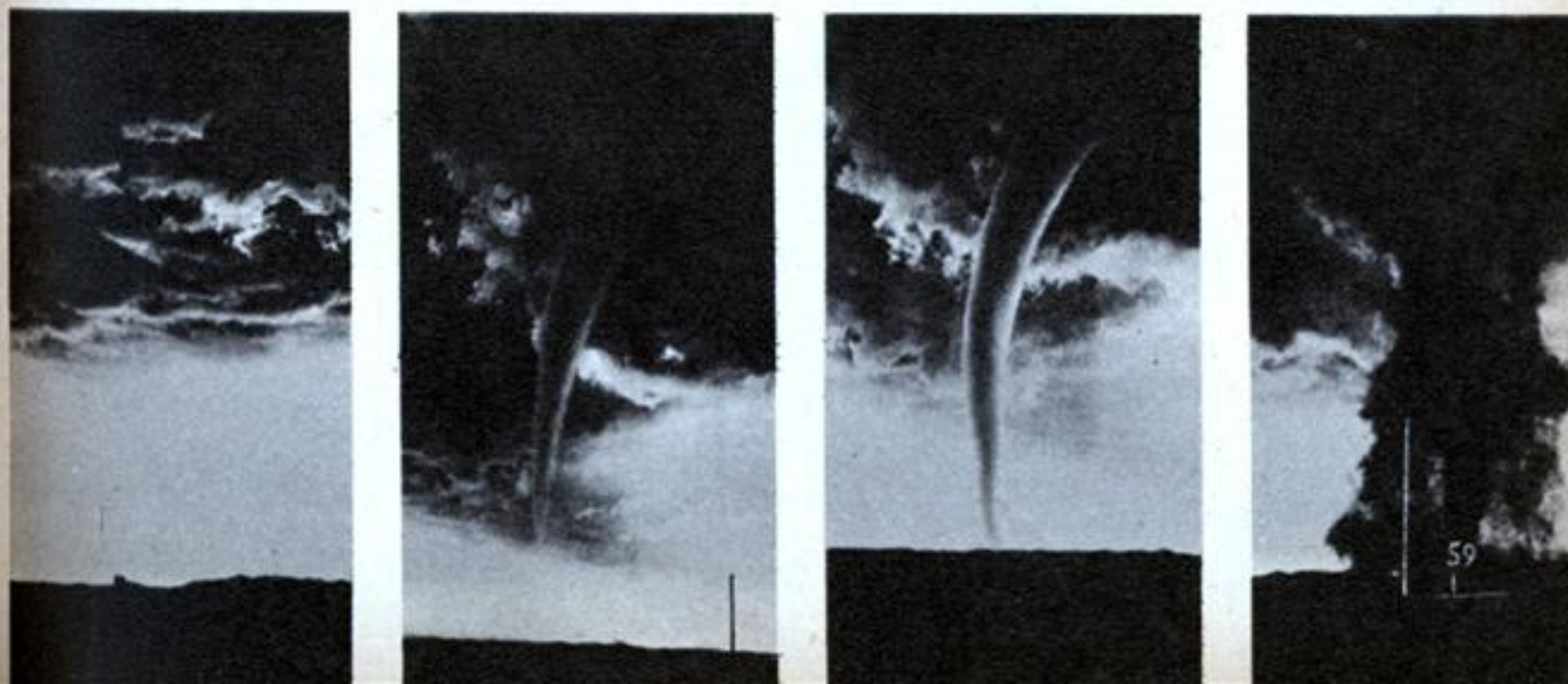
Realize that not too long ago, before electric refrigeration, most of our large cities depended upon ice for their ice-boxes. We don't miss the ice today because we have refrigerators, but we would if we had to depend upon those very same lakes. They just don't ice-over any more. Present-day New Yorkers who have never seen the Hudson River covered with ice find it hard to believe that once there was a regular ferry service over the ice to Staten Island. Many a five-year-old in "wintery" New England has yet to use a sled or throw a real snowball.

Our winters are milder and we are apt to overlook a comfortably warm winter season. But let there be a "day of the great blizzard" and everybody will remember it. Unpleasant weather leaves the greatest impression. Let winds and floods and storms increase and we immediately ask for a Congressional investigation to probe the possible effects of atomic radiation on weather.

If you are still upset, however, and feel you must worry about the distant future of mankind, forget the weather effects of atomic bombs and wonder what would happen if the ice reservoirs of Greenland and all the polar regions let go in one fast melting spree. The level of our oceans would rise about 200 feet. All our coastal cities would be wiped out and civilization would have to retreat to the highlands. As a matter of fact the polar icecaps are already receding at the rate of some 500 feet a year, causing climatic changes and raising the level of the sea about an inch during the last century. This is a sign of things to come.

The glaciers and ice reservoirs began their retreat about 20,000 years ago and by

Photos show development of a tornado. It appears suddenly, is very difficult to predict.



5,000 B. C. the weather had become much milder. Green forests spread into the northlands where they exist today. After the twelfth century however, the weather cycle swung low and the climate became more severe. Winters became longer and the glaciers reached their maximum during this "Little Ice Age" from 1650 to 1850.

Since 1850 the glaciers have been retreating under a climate of shorter winters and warmer summers. Despite the fact that our snowiest winter was but five years ago, you may discount that as being no more than a break in the cycle; the trend toward warmer climate persists. Whether it will fluctuate, become stronger or weaker, is all within the fancy of time. Certainly none of us will live to see such drastic changes as the melting of the icecaps.

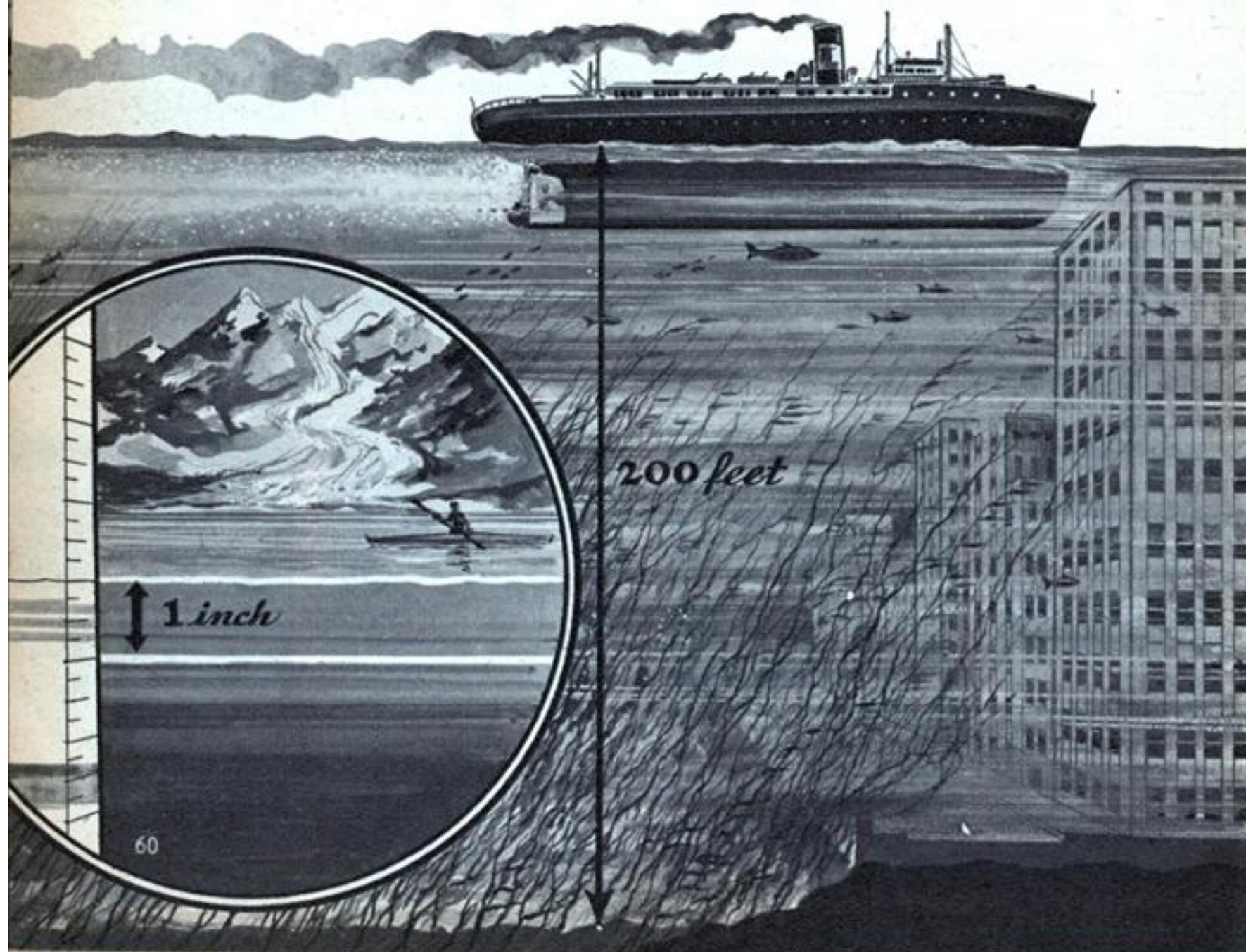
A tornado has no part in the machinery of climate. Rather it is the accidental loose nut that flies off the machine or the backfire of an otherwise normal storm cycle. A tornado is like a whirlpool where two tides meet. You can get the effect of one by rolling a pencil between your two palms. Each hand represents a different air mass; the pencil which turns rapidly but moves

slowly up or down each hand acts just like the long funnel of a twisting tornado. Try it and see.

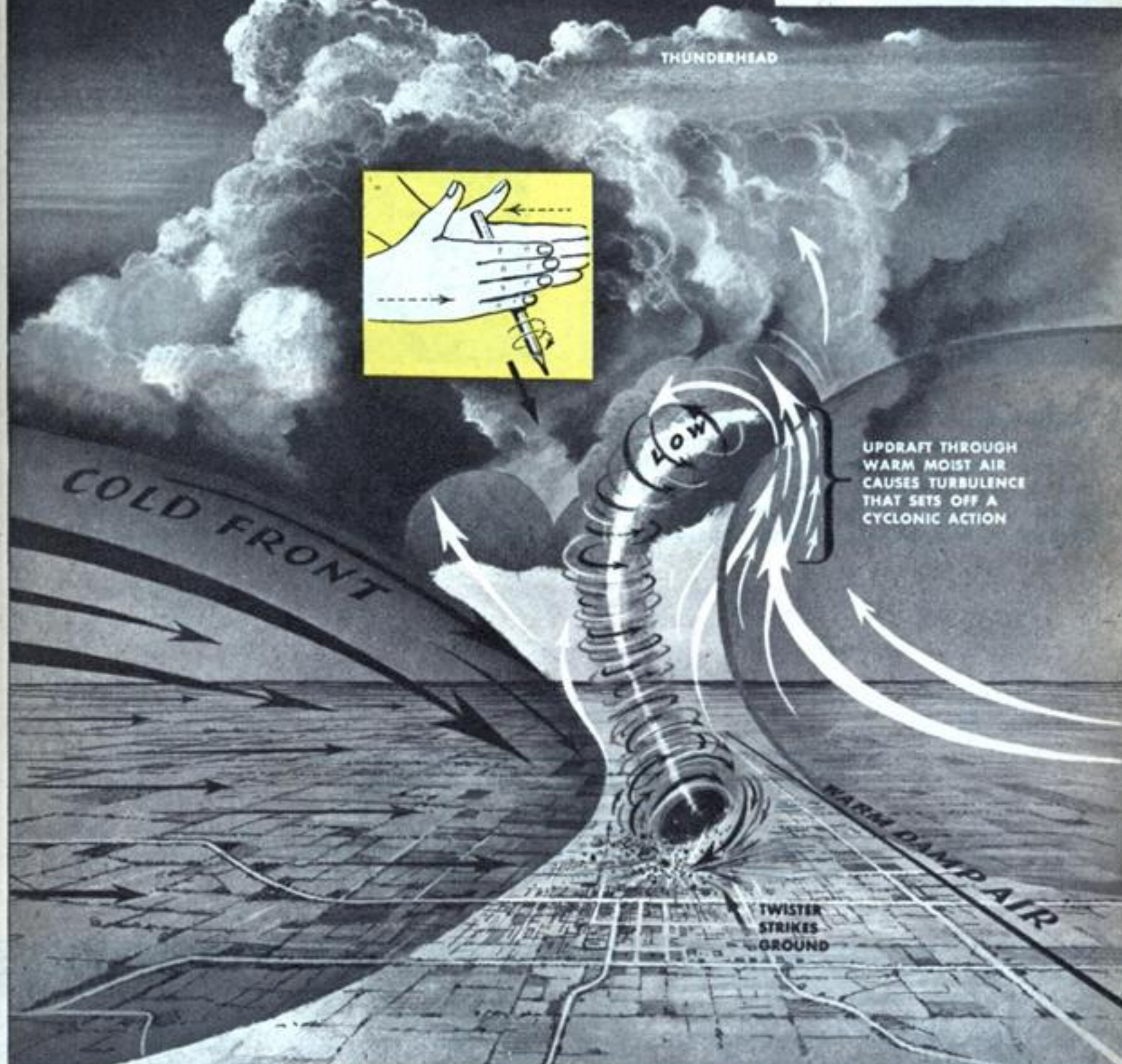
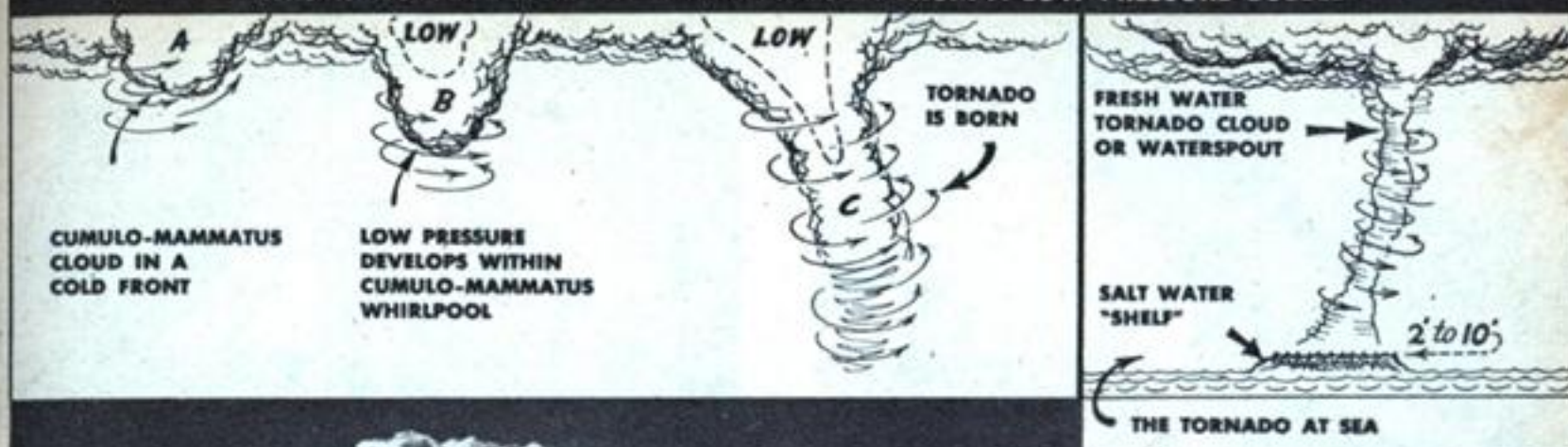
When a warm moist air mass meets a cold front head-on, the motion of the two different kinds of air (like the two hands), causes friction and extreme low pressures. Once a low pressure area funnels into a definite pattern, it will spiral earthward as a tornado "cloud" or funnel. The waterspout is just a tornado over the water and although most people think the waterspout contains water being sucked up from the sea, it is merely a cloud being formed by condensation within whirling air. The sea water sucked upward in a waterspout seldom rises more than two or three feet and when the spout disappears, tons of sea water do not fall back into the sea, but the fresh water forming the cloud just disappears back into the atmosphere again.

Whereas a 500-mile whirlpool (hurricane) will blow down a house, a 1,000-foot whirlpool (tornado) will suck down a house. Such concentrated low air pressure outside the house will make it explode outward, blown apart by high air pressure within the house just as an automobile tire

During the present century, melting of mountain glaciers has raised the levels of our oceans one inch, insert. But if the polar icecaps should melt completely, levels would be raised 200 feet or more.



THIS IS HOW A TORNADO FUNNEL IS BORN FROM A LOW PRESSURE BUBBLE



will also explode outward into the low pressure of a tornado.

The drawing shows in simple form a tornado forming along a cold front. To indicate the air mass which the "front" is the front of, you would need a magazine page 100-feet wide. The frontal storm machinery is huge, many times larger than

the storm itself and much too large an area to be formed by the aftermath of an atomic explosion.

Usually, about two days after a bomb blast in Nevada, radioactive particles fall on the east coast. This fact, along with unusual weather, is what has startled many people including [Continued on page 177]

How You'll Fly to the MOON

A critical moment on the first flight to the moon: Stage 2 roars out of its nest in stage 1 as the stage 1 fuel tanks run dry a few hundred miles up.

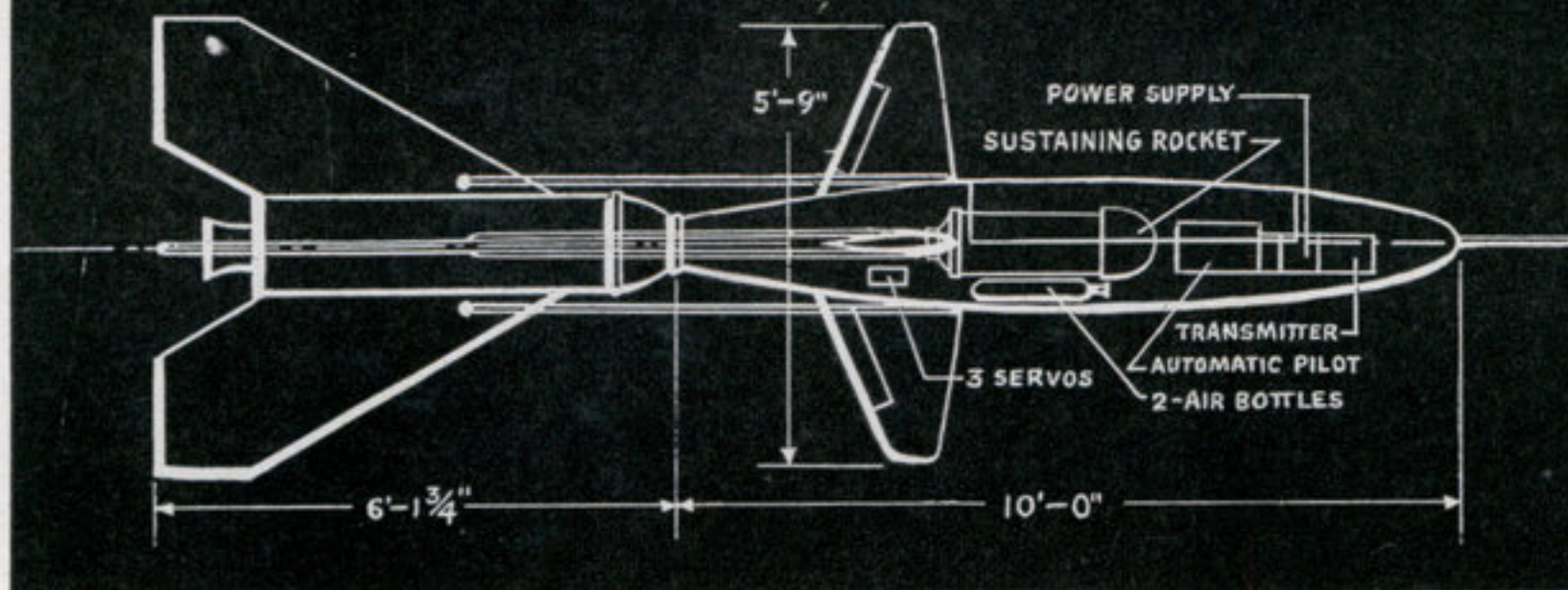


THE days of dreaming about a trip to the moon are over. The research destined to make that trip an actuality is already well under way.

Next May the first step on the long, long trail into space may be made: Man hopes to send something up that will never come down again (see "Going Up for Keeps," p. 66). In the words of Dr. Fritz Zwicky, the California Institute of Technology physicist who suggested the May satellite-making experiment, "We first throw a little something into the skies. Then a little more, then a shipload of instruments—then ourselves."

And other scientists agree. Dr. James A. Van Allen, of the Johns Hopkins University Applied Physics Laboratory, anticipates sending a rocket to the moon (one way, no crew) *within 15 years*. "A conservative estimate," he says. Maj. P. C. Calhoun, chief of the AAF's guided-missile branch, expects to travel to the moon and back in his lifetime. And the University of California at Los Angeles already offers a course in rocket navigation!

How the journey will be made is even now known in considerable detail. Rocket experts at Johns Hopkins and Caltech report that the space ship will look like this: A number of separate rocket motors (probably between three and five), each with its own fuel tanks



and controls, make up the power plant. The first motor, or stage, pushes the ship up a few hundred miles, when, its fuel exhausted, it is dropped off. The second stage then starts automatically and accelerates the ship until it uses up its fuel and is jettisoned. This process continues, each stage adding more speed, until the last stage completes the job of getting the 22,000-m.p.h. velocity needed to escape from the earth's gravitational pull. Once free of the earth, the space ship can coast to the moon (there would be no air resistance). Only a little power would be needed for steering.

The multistage system eliminates the dead weight of big, almost-empty fuel tanks and seems to offer the most economical method of securing extremely long range. Tests of one of the first practical rockets of this type have already been made.

This rocket, the Tiamat, developed by the National Advisory Committee on Aeronautics, has two stages. One of its most important features is an accurate control system that permits it to be flown through fairly complicated maneuvers. Although quite small—less than 15 feet long and weighing about 600 pounds—it is probably a good indication of the design of the moon rocket of the future.

The jump from the Tiamat's 600-m.p.h. speed to the 22,000 m.p.h. needed for a trip to the moon is a big one, but not impossible. Twenty-two thousand miles an hour is not as fantastic a speed as it seems. The single-stage V-2 already gives 3,500 m.p.h., and succeeding stages would have the big advantages of reduced gravitation and complete absence of air resistance—both important factors.

Not that you can ride to the moon by hitching three V-2s together. If a multistage rocket uses a V-2 for the *first* stage

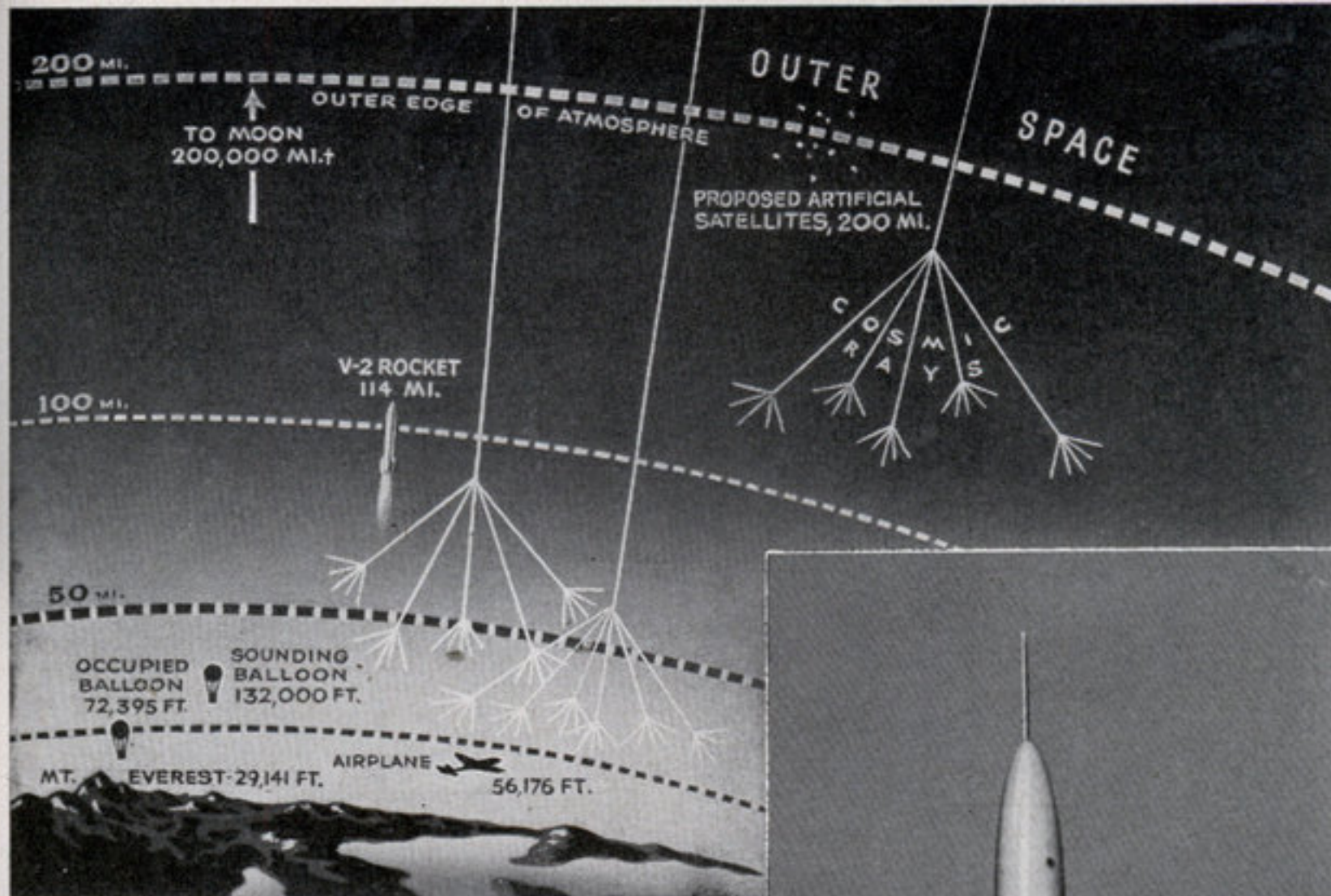
In the Tiamat, one of the first multistage rockets tested, the second stage is simply fastened to the front end of the first stage without the involved nesting arrangement needed for a moon rocket.

(that, essentially, is the satellite-making rocket to be fired during May) the pay load in the *final* stage is a steel fragment smaller than a dime. Engineers can also calculate how big a ship able to reach the moon would be if its final stage were a V-2. Alfred Africano, pioneer in rocket development and now project engineer for the Curtiss-Wright Corporation, did the arithmetic. The answer is 5,500,000 tons.

But these calculations are based on the motor and fuels employed in the V-2. Although this power plant is the most efficient now known to be in use, it still needs nine tons of liquid oxygen and alcohol and four tons of motor and airframe to lift a one-ton pay load. Much higher efficiencies are reported to be possible with fuel and motor combinations already being tested by the rocket researchers.

Better fuels—that is, hotter fuels—have been available for a long time. Rockets run on heat. The hotter the gases in the combustion chamber, the greater their pressure, the higher their speed as they shoot out the nozzle, and the faster the rocket is pushed ahead.

On that basis, hydrogen and oxygen would make the most effective fuels. When these two elements combine to form water, the reaction releases more heat per pound than any other now known. The best rocket would actually be a steam engine! Using hydrogen and oxygen as fuels, a moon rocket would need only five stages, according to the calculations of Martin Summerfield, of California Institute of Technology, a leading American authority on rockets. It would be



The ceiling over man's upward journeys is rapidly being raised, as shown in the drawing above. Much information on cosmic rays may come from higher trips (see "Why B-29s Hunt Cosmic Rays," p. 121).

72 feet long and would weigh about 25 tons, about twice the size of the V-2.

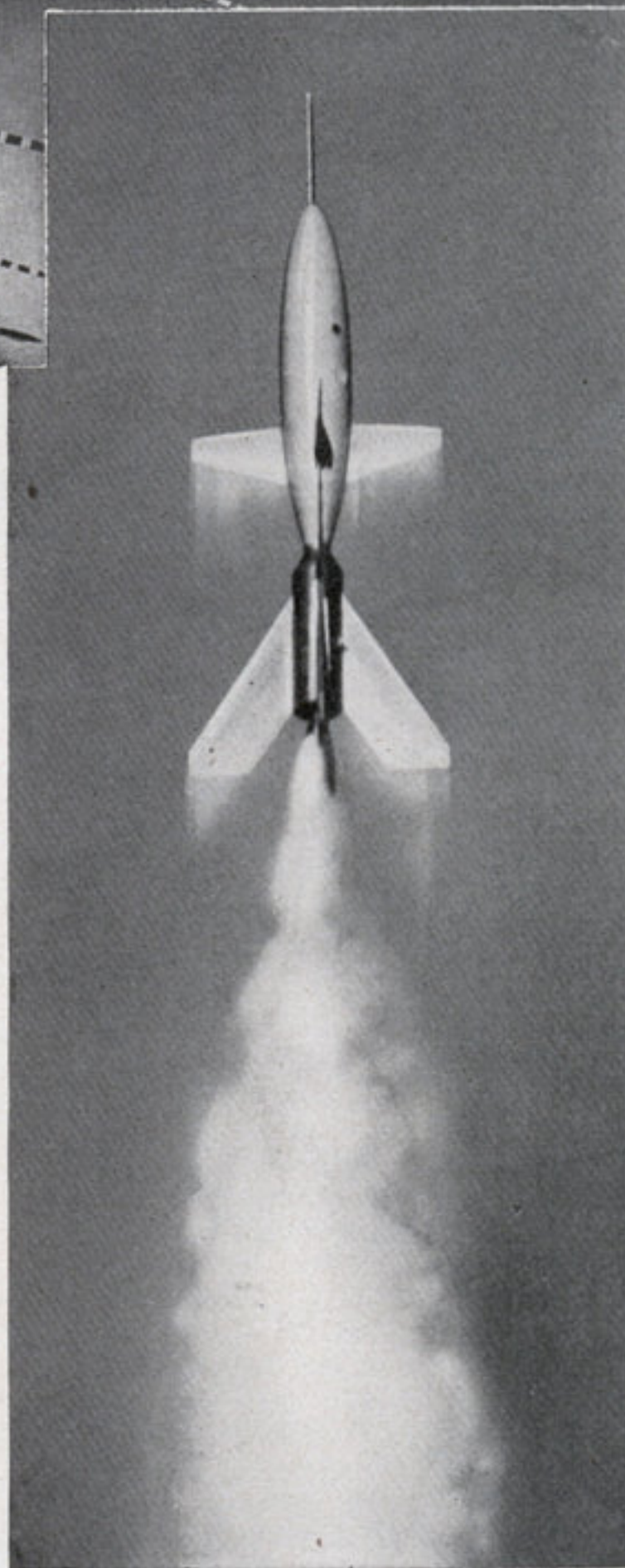
Yet the tremendous heat available in oxygen and hydrogen—the characteristic that makes them so desirable—is the very reason they are not used. No lightweight motor can stand that temperature.

Present rocket motors are cooled by double-walled jackets through which one of the fuels is pumped. The fuel takes heat away from the motor and at the same time is warmed up itself for easier burning in the chamber. Ethyl alcohol, the V-2 fuel, works very well; its rate of burning (which determines how fast it is pumped through the cooling jacket) is about the same as its rate of heat absorption. For hydrogen, this is not true. It absorbs less heat per pound and must therefore be pumped through the cooling jacket, and burned, faster. The result is an inefficient flame—or else the motor burns out.

If hotter fuels are to be used, new heat-defying motors must be made. Research in that direction has already been quite successful.

One group of materials that can withstand

Tiamat's first stage, shown here operating at start of flight, runs for $3\frac{1}{2}$ seconds. Then it drops off. Top speed, secured with second stage, is 600 m.p.h.



WATER WINGS of PLASTIC

A MAN, a boy, and a girl walk to the edge of a swimming pool, dive into the water, swim the full 75-foot length of the pool, climb out at the other end, and briskly follow each other off the three-foot-high springboard, each slicing into the water in a dive which cuts the surface like a knife.

What's so remarkable about this?

Nothing except that the man is a war veteran whose entire right arm and lower left leg are missing, the girl is a tiny tot who is not quite four years old, the boy is a 10-year-old who has been a victim of severe spastic paralysis since he was a baby. And until three weeks before not one of

The old-fashioned water harness has been outmoded by gayly colored swimming aids.

BY DON ROMERO





these people had ever swum a stroke in his life.

What is perhaps even more remarkable, however, is that as swimming students impeded by critical handicaps, yet well on their way to becoming strong, confident swimmers, these three people are the product of a new method of instruction which—believe it or not—is now successfully proving that the very best way to begin teaching a child or adult to swim is simply *not to teach him at all*.

The number one problem is to get rid of that awesome fear of the water which our parents and teachers so thoroughly and diligently drilled into us as children. Most instructors now agree that, far from being the mysterious and hard-to-learn art so many people believe it to be, swimming is basically an instinctive ability which should come to every human as naturally and easily as crawling does to a baby or walking does to a small child.

Top: This coy naiad finds a colorful setting among the brightly hued water sleds. They're made from thermoplastic Vinylite.

Right: The light-as-a-feather swimming aids supply fun as well as instruction. Water-baby in the center is astride a "torpedo."



Working on this theory, coaches are devoting themselves to "conditioning" their students to the water, which means nothing more than getting them used to standing, sitting, lying, running, falling, and splashing in it until they have thoroughly assured themselves of how soft, pleasant, and buoyant it is.

To do this, instructors are now using a new set of swimming aids which, unlike the harness-like contrivances often employed for swimming instructors, look like gayly-colored, balloon-like objects especially designed for water games. Manufactured by the Du Page Plastics Company of Chicago, they are made of a light-weight thermoplastic Vinylite sheeting which is as flexible as rubber, soft as satin, and which can be quickly inflated by mouth. These aids consist of a "torpedo," which looks something like a giant hot dog about four inches thick and three feet long; a number of rings, ranging from four to six inches in thickness and from 18 to 36 inches in inner diameter; a cushion about three inches thick and approximately 18 to 22 inches square; a number of "fun" balls, ranging from 14 to 22 inches in diameter, and a water sled made up of four torpedoes welded together side by side to form an extremely light raft two feet wide and from four to six feet long.



How's this for a masterpiece in pulchritude and plastic? Below: Inflating fun balls and torpedoes at the factory.



UNDERSEA SPIES

BY JAMES NEVIN MILLER

BACK in December, 1944, Lieut. Earl E. Cook of Seattle, won the Navy Cross for a unique achievement. First, in a successful effort to locate three enemy depth bombs known to be in immediate danger of detonation, he dove deep inside a patrol bomber sunk in a vital channel off Oahu, Hawaii. Then for three never-to-be-forgotten days he directed a six-man team of divers which finally recovered the death-dealing weapons.

This daring young officer was one of a group of "under-sea spies" who undertook the most dangerous and difficult assignments of the war. Trained with painstaking care in a unique type of Intelligence work, most of them were members of the Navy's underwater demolition teams.

Unarmed, dressed only in swimming trunks, members of these teams swam to action, braving enemy fire and sharks, to clear with explosives any natural or man-made obstacle from the beaches chosen as objectives of our amphibious landings.

These "spies in trunks" in many instances were provided with revolutionary equipment that furnished underwater



At depth of 20 feet, diver works on anti-torpedo net.

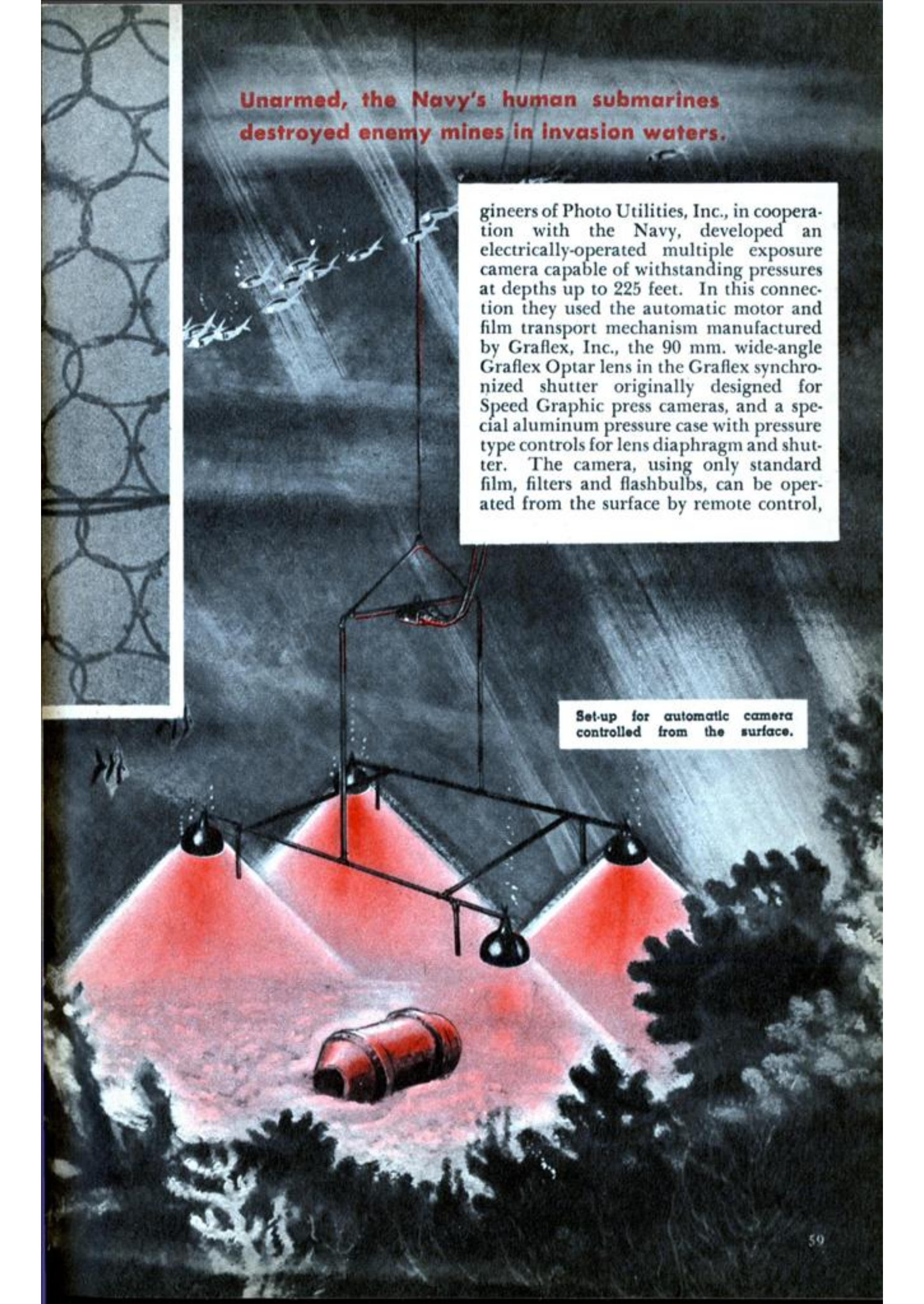
photographic eyes for their special brand of sub-sea Intelligence. Incidentally, this new equipment is expected to have important applications in peacetime salvage.

Right after Pearl Harbor, faced by the problem of determining accurately the amount of damage to American warships crippled or destroyed by the Jap sneak attack, the Navy found existing underwater photographic equipment and techniques impractical in the extreme depths and dirty water in which they were forced to work. Sketches made by divers from personal exploration took precious time and lacked the extreme accuracy and detail required for salvage work.

So it happened that the en-



Four tons of tetrytol placed by under-sea spies explode off Peleliu beach on day preceding Marines' attack.



**Unarmed, the Navy's human submarines
destroyed enemy mines in invasion waters.**

gineers of Photo Utilities, Inc., in cooperation with the Navy, developed an electrically-operated multiple exposure camera capable of withstanding pressures at depths up to 225 feet. In this connection they used the automatic motor and film transport mechanism manufactured by Graflex, Inc., the 90 mm. wide-angle Graflex Optar lens in the Graflex synchronized shutter originally designed for Speed Graphic press cameras, and a special aluminum pressure case with pressure type controls for lens diaphragm and shutter. The camera, using only standard film, filters and flashbulbs, can be operated from the surface by remote control,

Set-up for automatic camera
controlled from the surface.

yet it is compact enough to be carried and operated by a single diver.

Because of the extreme murkiness of choppy waters and great depths, most undersea photographic work requires from one to four standard size flashbulbs. Special waterproof socket reflectors developed by the Mines Equipment Co., prevent the danger of short circuits and make it possible to change bulbs under water. In crystal-clear areas of the Pacific however, standard snapshot exposures are possible at depths as great as 100 feet.

Extreme depth of field and focusing from two feet to infinity are possible with a helical mount which moves the film toward and away from the lens instead of the opposite standard procedure.

A dome-shaped aluminum pressure case protects the camera from damage by water or pressure. For the first time in undersea equipment, the curved protecting glass over the lens forms an integral part of the optical system, providing critical definition under all conditions. Special waterproof compartments within the camera prevent total damage in case of accident to one or more sections.

Getting back to the exploits of the "underwater spies": exactly how they were able to invade enemy beachheads to pave the way for landings in force probably never will be told in its entirety. This much, however, may now be revealed: They were the first ashore and al-

After special cutting charge is secured, diver anchors firing cable leading from charge to surface.



A member of an Undersea Demolition Team relaxes on pickup boat after setting charges at Balikpapan.

ways faced the risk of heavy casualties. In fact, their losses in Normandy were as high as 40 per cent.

Yet their work was vital to the success of our landing operations. They cleared enemy beaches of obstructions. They blasted ways through reefs so landing ships might enter. Their sacrifices helped to keep down the casualties among the soldiers who arrived on the succession of D-Days in the Pacific, invariably days

Sub-surface glider with observer is used to search for mines, is towed by surface craft at 3 knots.





Undersea spy approaches objective and (right) anchoring light before photographing mine.

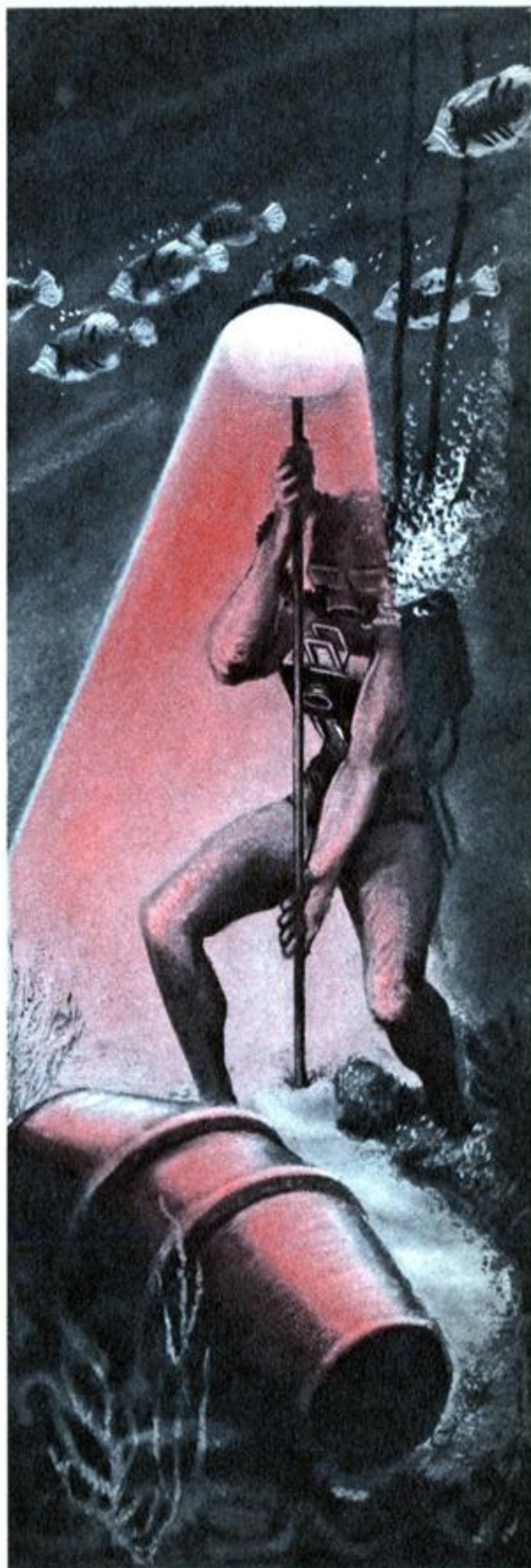
after the sub-sea Intelligence experts had done their work.

The first training school for underwater demolition teams was organized by Commander Draper L. Kauffman of Bethesda, Md. He and his daring associates went through a big part of the Pacific war.

"Every time our men went in," he said, "they expected to suffer heavy casualties. After one or two operations we felt certain that the Jap would take steps to prevent our accomplishing future jobs other than by simply shooting at us. We expected to be blown sky high by mines waiting for our swimmers and to find other traps specifically designed to stop us when the teams left their boats and swam in to carry out reconnaissance and demolition of obstructions. These the Jap failed to do and contented himself with plastering us with cannon, rifle and machine gun fire. We didn't want to emphasize his mistakes."

In open daylight jobs destroyers and converted destroyers, cruisers and even battleships, along with bombing and strafing planes, kept the enemy at bay while our underwater experts worked around reefs and along the beaches.

The value of the sub-sea spies was twofold. They [Continued on page 157]

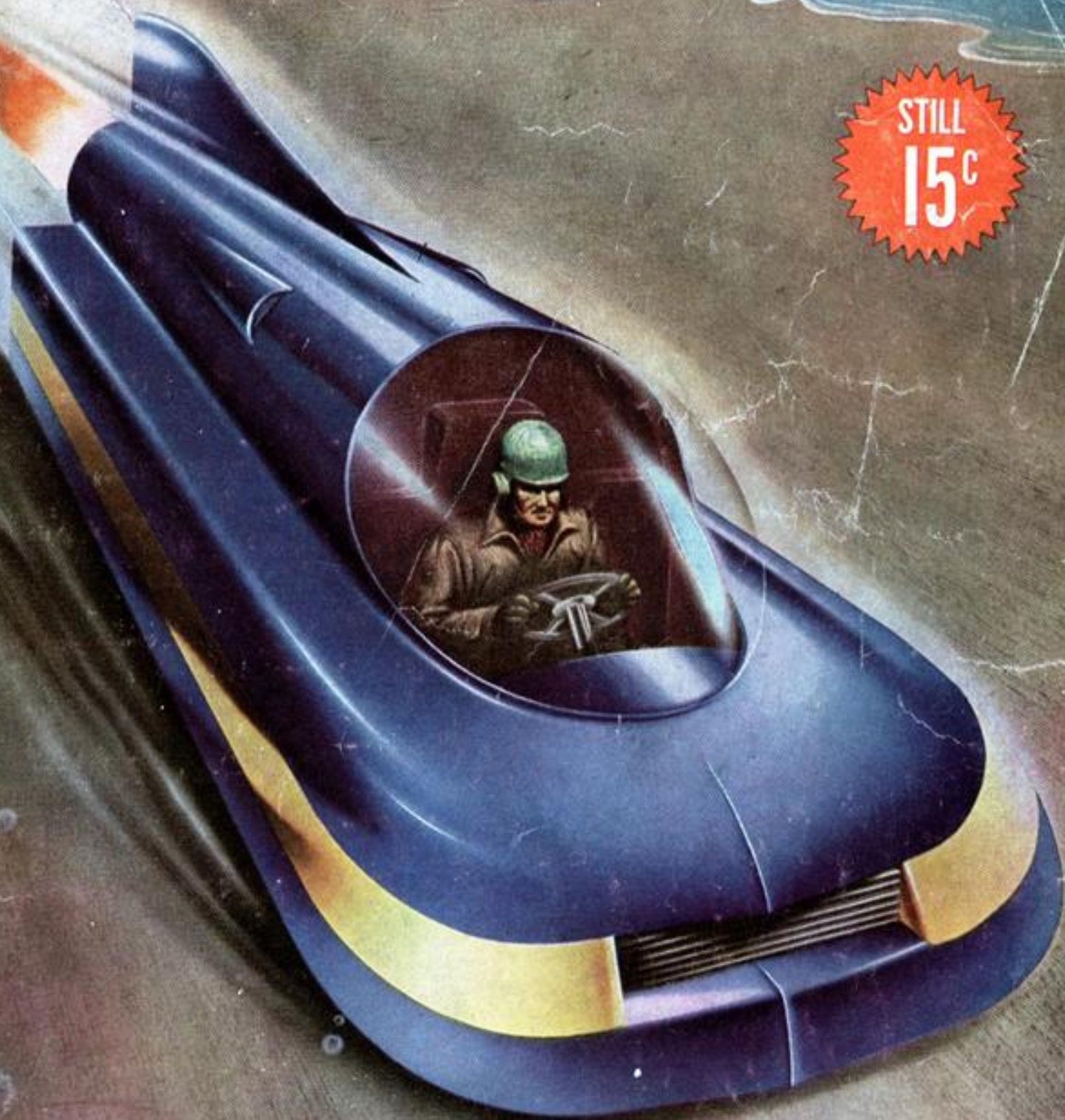


MECHANIX ILLUSTRATED

A Fawcett Magazine

FEBRUARY

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JET-PROPELLED RACER—EXCLUSIVE ARTICLE BY
CAPTAIN EDDIE RICKENBACKER ON PAGE 41

WE TEST THE NEW CARS
IN THIS ISSUE... FORD AND BUICK

New Records Ahead!

New power sources will make startling speed records on the speedway!

BY CAPTAIN EDDIE RICKENBACKER

NEXT May 30th at Indianapolis will be the red letter day for racing enthusiasts from all over the country—Long before the start, the stands will be jammed, as they were before the war, with engineers, designers, manufacturers and thrill-seeking fans watching the pits with an intensity seldom seen in any other sport. As starting time approaches, deep-throated roars will electrify the air. From the pits tiny jewel-like machines will again emerge, guided by many hands making last-second adjustments. The pay-off for many sleepless nights and hundreds of work-hours is at hand.

Indications are that the next race will be not only the best in the history of the track but by far the most important, because hundreds of war developments such



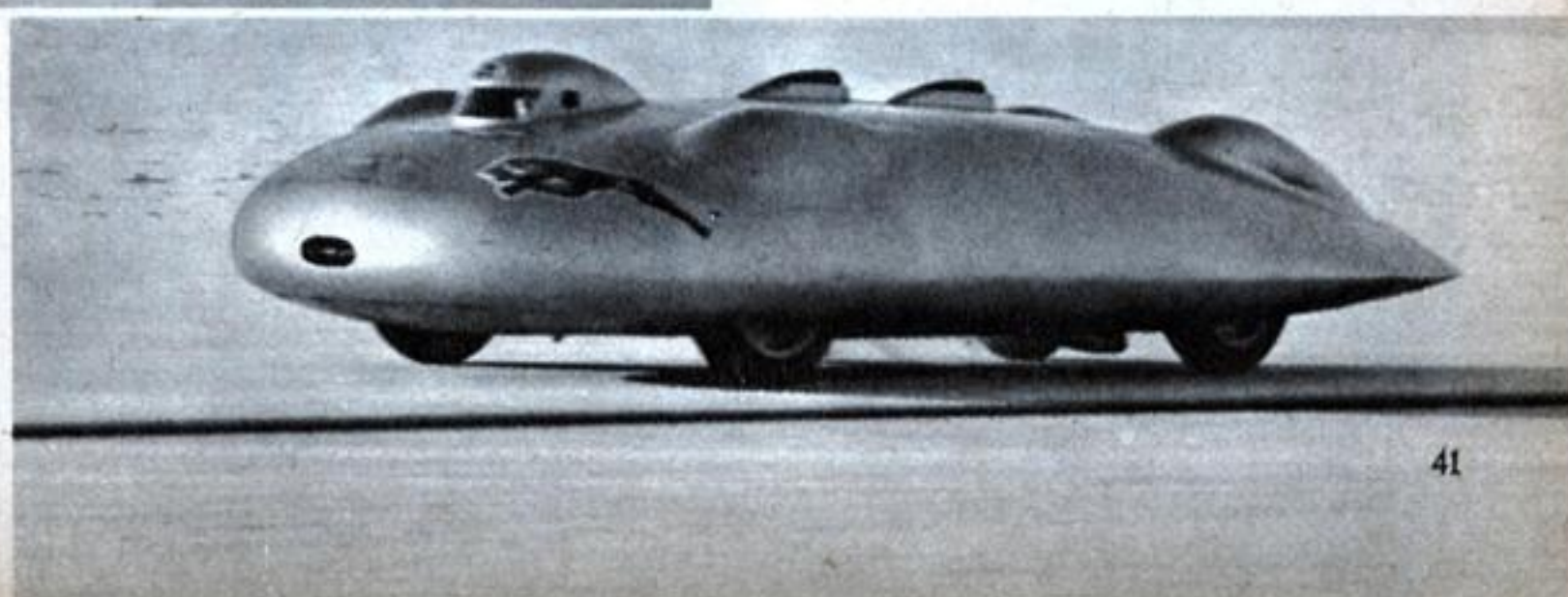
Photo by Tom McCahill

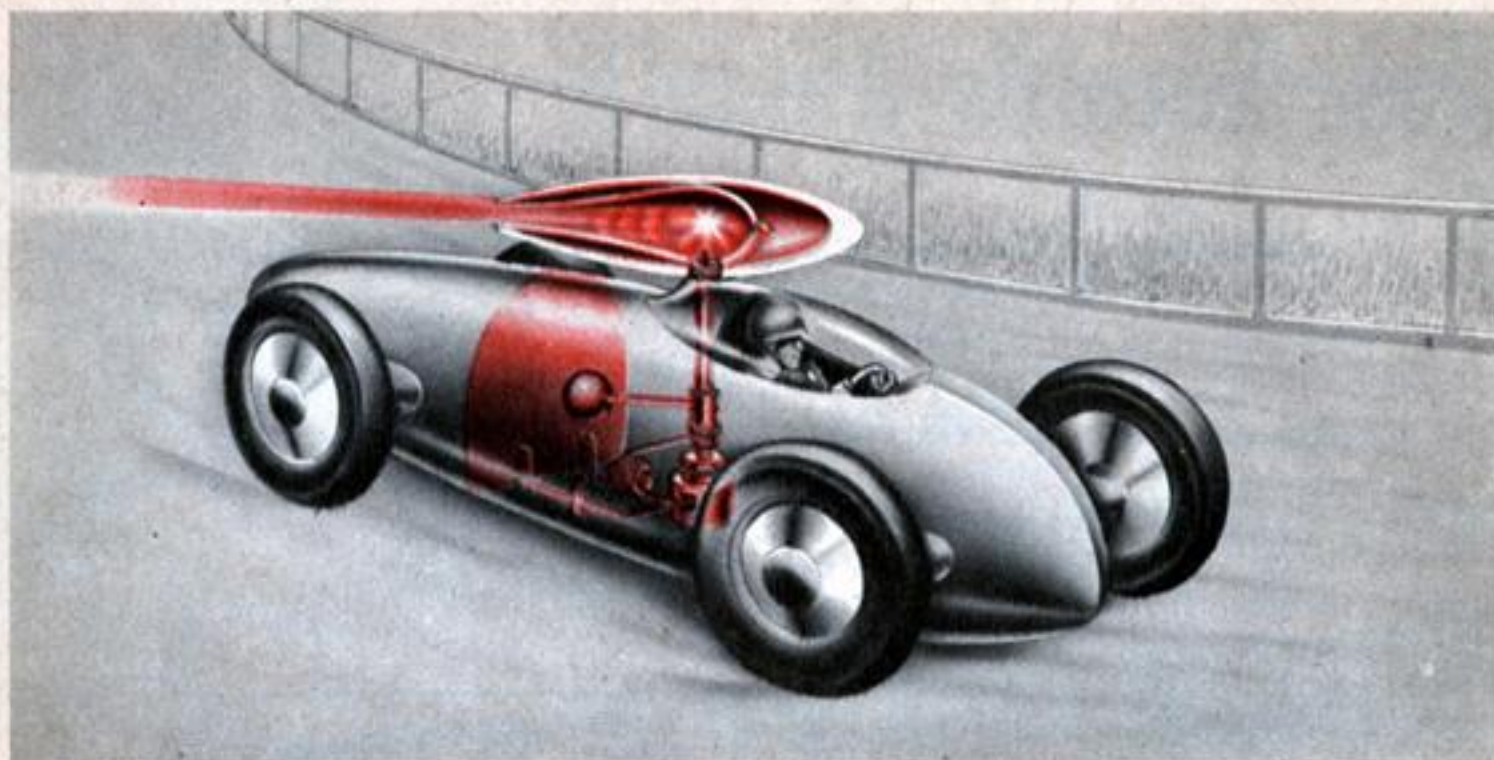
Everyone knows of Captain Rickenbacker's vivid exploits since the days he was ace of World War I, but some may have lost sight of the fact that he is a successful business executive in addition to being a promotion and creative genius. Today Captain Rickenbacker is president of Eastern Airlines as well as the Indianapolis Speedway, besides being the active chairman of the contest board of the Automobile Association of America. Shortly after World War I Captain Rickenbacker built his own stock car, the "Rickenbacker" and this car brought to the public many features then considered revolutionary, such as 4-wheel hydraulic brakes, short stroke and high compression engines, light pistons and a host of other innovations. And for this reason any predictions in this article, regardless of how fantastic they may seem at the moment, should not be taken lightly.—Editor.



as turbine jet-propulsion, new lubricants, and fine synthetic rubbers are still unproved for civilian use. Here they will be given the acid test. This race should be the transportation tip-off for years to come, as it usually takes about three years for an improvement to get from

John Cobb's Rallton Red Lion Racer, which set world's speed record of 369.7 mph. in Utah in 1939. (Left) Putting the racing body over racer's chassis.





Artist's drawing of a proposed racing car using a rocket mounted on a shaft. The rocket is turned by the action of centrifugal force exerted on a counter weight, keeping the car on the road in a curve.

the racing machine to the stock car.

Noise has always been a big part of the Speedway. Whether it was the bell-like tone of a perfect engine screaming along the back stretch or the crescendo roar of supercharged dynamite flashing by the stands, it was unsurpassable music to the ears of the fan. The next race promises to be a combination of many sounds never blended before, for to the thunderous roar of the gasoline engines will be added the giant blow torch sounds of gas turbines and—perhaps—the rocket-like swish of jet propulsion.

Since the start of the war gas turbine engines have been developed to such a point that many of the country's top engineers feel that this type of power will completely replace the conventional gasoline engine in stock cars before long. The gas turbine offers many important advantages over the internal combustion engine, such as at least twice the horsepower per over-all size and weight, speed and acceleration beyond anything we have known, and, above all, unequalled economy of operation.

This type of engine is usually built



Gas turbine race car. Steering gear controls automatically regulating valve for auxiliary side jets, which neutralize centrifugal force and permit the proposed jet-propelled racer to take turns at full speed.

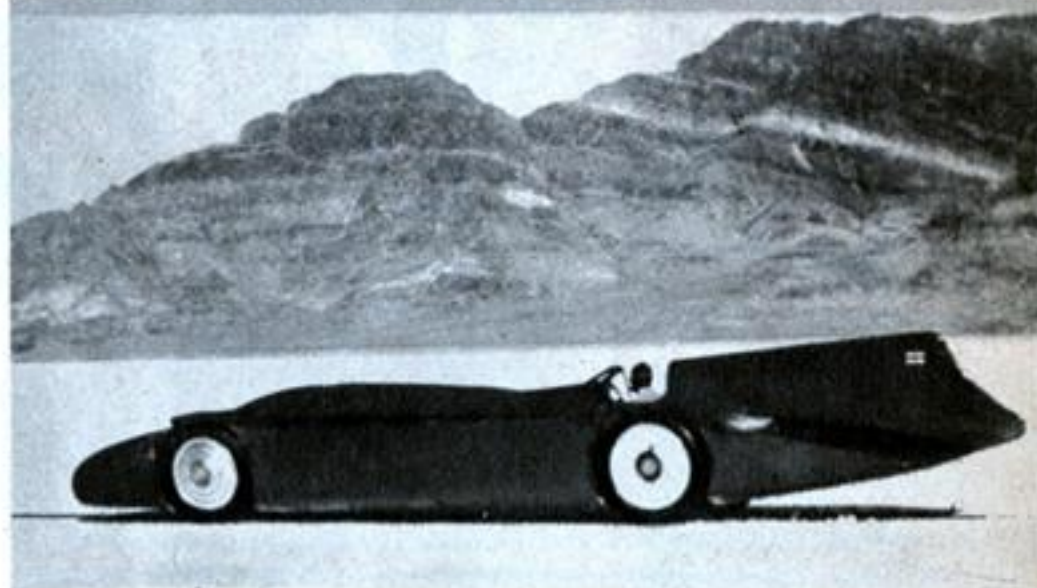
with only one internal moving part, which includes the air compressing and turbine blades on opposite ends of a single shaft. Compare this one part with the hundreds inside your own automobile engine and you will realize the simplicity of upkeep. For fuel the gas turbine will operate on anything from fuel oil or kerosene to gasoline and the same features that make the new Army fighting plane, the P-80 Shooting Star, outstanding will also be responsible for unheard of acceleration and top speeds in future race and passenger cars. With gas turbine engines, speeds of well over 200 miles an hour are expected on the Indianapolis straight-away with averages close to 200 for a complete lap. It was in 1914, right after Carl Fisher expressed doubt that anyone would ever complete a lap at the amazing speed of 100 miles an hour, that Julius Boillot did it. Now, 32 years later, 200 miles or better is expected with the first new type of power plant in more than half a century.

Chassis design will be greatly affected by this new type of power because of the lightness and shape of the turbine engine. In the present conventional car, the crankcase is usually the low point of clearance because of the necessity of an oil reservoir below the crankshaft and main bearings. The turbine without a crankcase will permit engineers to build chassis with a much lower center of gravity and this will vastly increase the roadability of all cars, especially the light ones. The turbine eliminates the ignition and cooling systems, and the actual r.p.m.'s of the engine are instantly controlled by the opening and

closing of the throttle, because such factors as automatic spark advance and acceleration pumps have been eliminated, making maximum power almost instantaneous when desired. This will account for almost fantastic acceleration after rounding a turn on the Speedway or getting a green light in a passenger car. It is also felt in some automobile circles that because of the turbine's flexibility, clutches and transmissions, except for a reverse gear, will be completely eliminated; this should vastly reduce the cost of a vehicle [Continued on page 77]



Midget auto racer at a '42 race in Los Angeles. (Below) Sir Malcolm Campbell setting the '35 record of 301 mph.



New German 3,000 hp. Daimler-Benz racer.



Amazing New Picturephone

A step closer to in-person

By W. STEVENSON BACON

There's a brand-new Picturephone in the works that will one day give you instant total communication with anyone you call. What makes it fascinating is the amazing versatility of the delicately engineered unit that holds both picture and camera tubes.

Unlike the old Picturephone, this one gives you a choice of wide-angle picture, long-range shot, or electronic close-up. Pull a lens out and aim it downward, and you can send pictures, drawings, or printed documents. If you wish, you can push

a button to see what you're sending. And if a call catches you in the shower, you can simply switch over to a three-bar test pattern.

Bell Telephone Laboratories packed all this into an 8-by-11-by-14-inch box by using tiny integrated circuits that incorporate hundreds of transistors and other components on small chips of silicon. In fact, the only vacuum tubes used are the picture and camera tubes. And even the camera tube makes use of semiconductors.

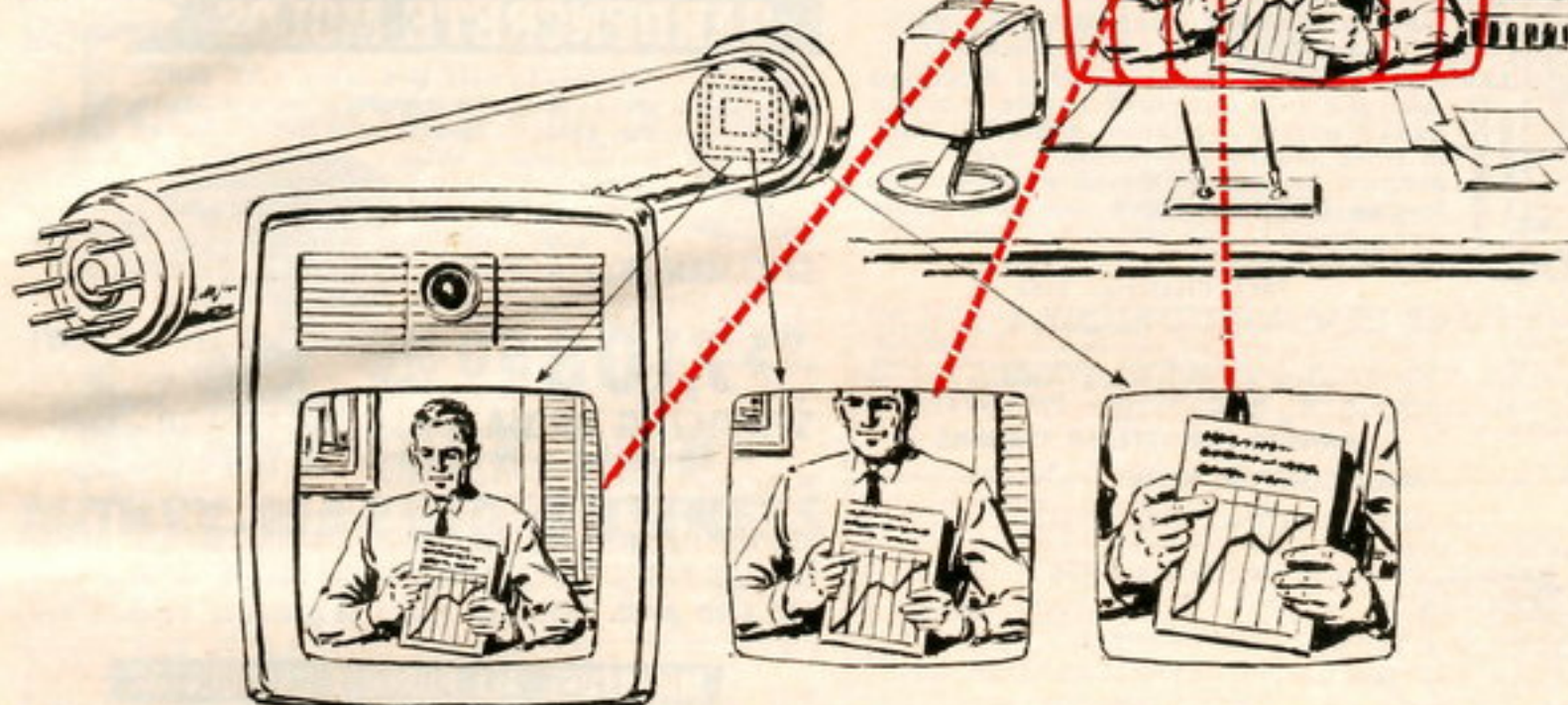
The camera tube is a revolutionary new type that uses a target (the part of the tube that converts incoming light



Picturephone II sits elegantly on pedestal with control unit and Touch-Tone phone used for dialing. Control unit regulates camera height, electronic zoom, image brightness, and speaker volume. Pushbuttons enable user to answer a call, monitor own picture, etc. "Graphics mode" with swing-out mirror is shown above.

Unique electronic zoom is done, not with lenses, but by scanning successively smaller portions of the silicon photodiode target in camera tube. Tube is the first to combine semiconductor target with electron-beam scanning. It is the target that makes zoom effect possible, as such use would destroy target material in ordinary tubes.

visits via TV



to electrical charges) made of silicon and containing 300,000 light-sensitive diodes formed on it by integrated circuit techniques. It's the first time that semiconductors and vacuum tubes have been combined to make one device.

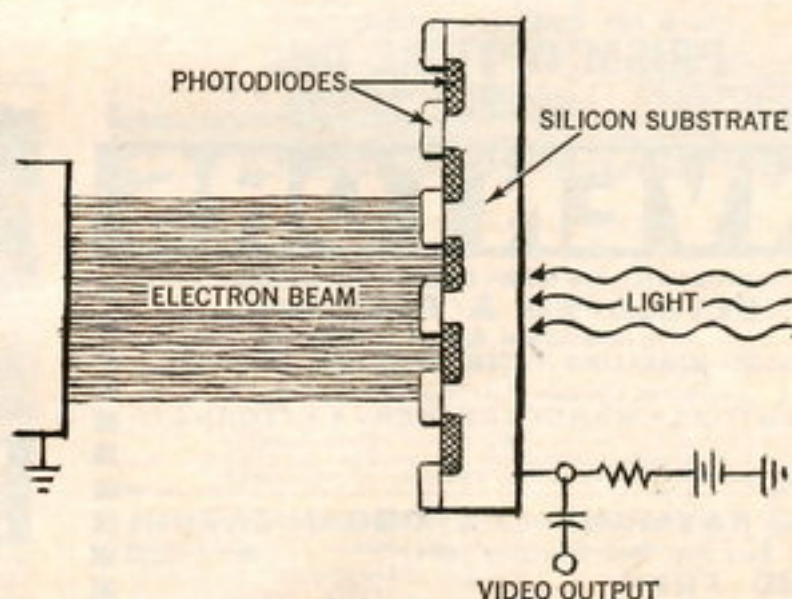
Advantages, compared to an ordinary TV camera, are enormous. This one takes close-ups *electronically*. By adjusting a knob, you simply frame off a smaller portion of the target for scanning. It operates over a wide range of light levels and can even be exposed to direct sunlight. Finally, it is not vulnerable to "burn-in," the phenomenon that causes a conventional TV camera, focused on one scene for too long a time, to transmit a ghost image later.

With Picturephone II, the user can change freely from side to side while remaining in the picture, or focus the camera to transmit scenes up to 20 feet away. Part of the wide-angle effect is owed to the lens, part to a bigger screen: five by 5½ inches.

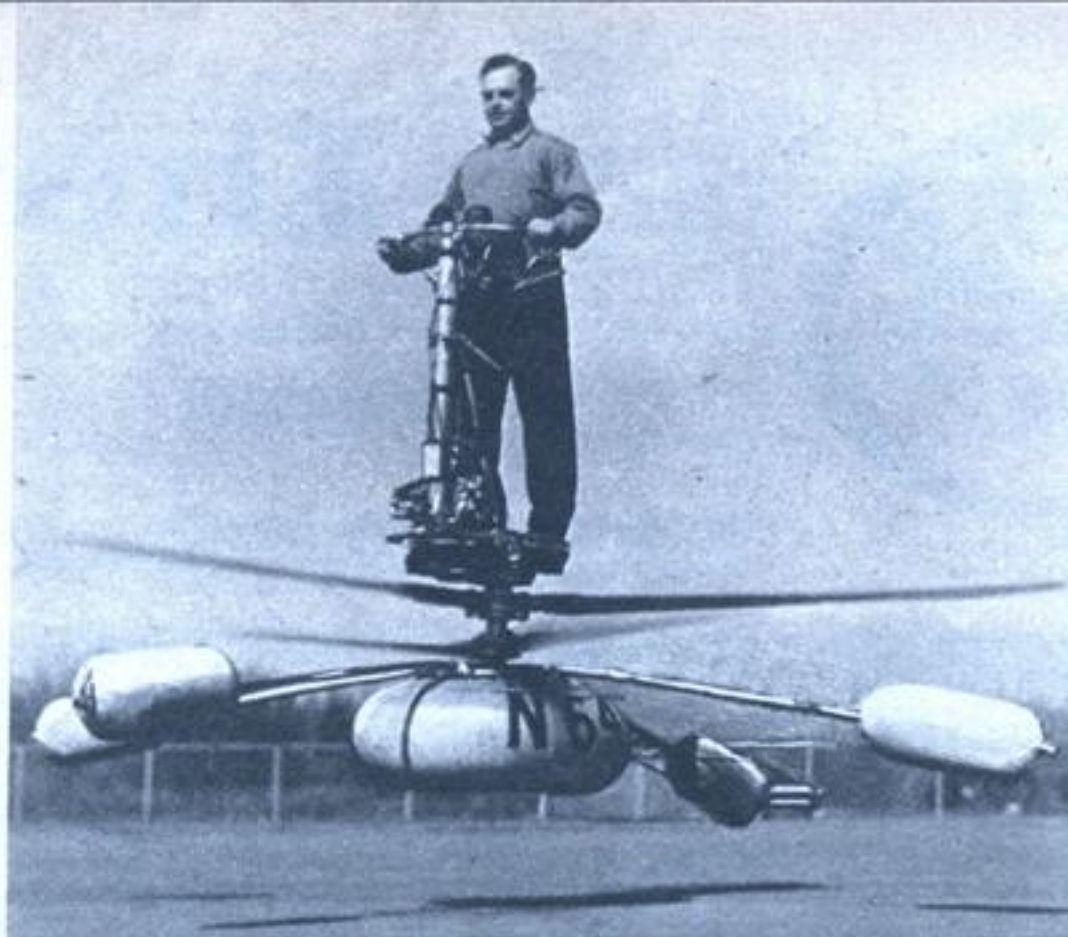
For transmitting documents, a built-in mirror swings out in front of the camera lens. Charts, graphs, and pictures are simply placed in front of the pedestal.

When can you have one? Best guesses are that it'll be 10 to 15 years, although some may go into commercial service in the early 70s.

First tests will be this September between Westinghouse offices in Pittsburgh and New York. The tests will guide further development, looking toward the day when you'll have a new Picturephone right in your own home.



Integrated-circuit techniques are used to make silicon target, which contains 300,000 light-sensitive photodiodes. Diodes are reverse-biased by the electron beam; they conduct as light strikes silicon.

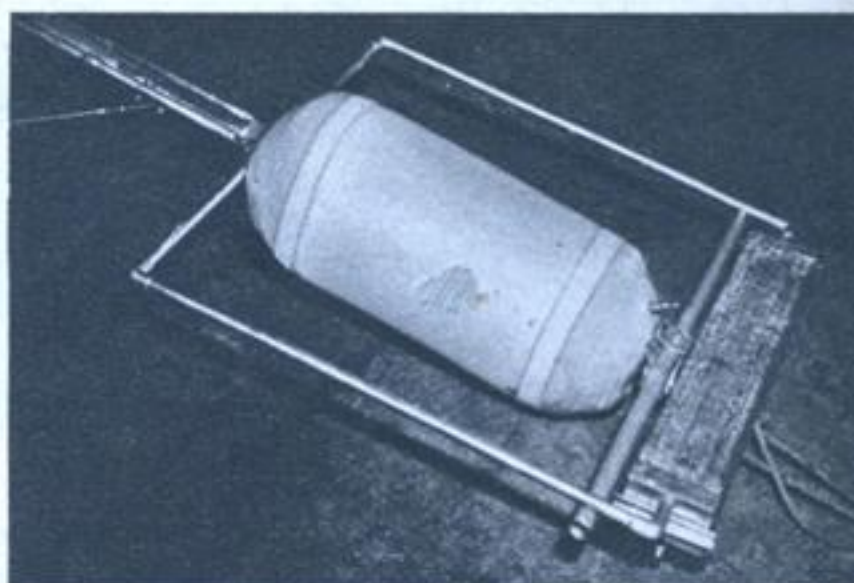


Stand Up and Fly

Pilot check-out time on this job is an easy five minutes. Right hand twist-grip throttle controls power.

You're a human hummingbird on the new de Lackner helicopter.

LIKE the flying manhole cover, the new de Lackner helicopter carries only one man who hangs on to handlebars, controls pitch and roll by shifting his weight. Unlike the manhole cover, it is very light (a 125-lb. model is planned) and it is amphibious. Maximum cargo: 200 lbs. Cargo-lifting line runs down through hollow rotor shaft; this method frees copter of cargo inertia during pitch and roll. Top speed is 65 mph, hovering ceiling is 5,000 feet, fuel capacity is one gallon, range is 15 miles. Auxiliary five-gallon fuel tank boosts range to 50 miles. Builders are de Lackner Helicopters, who have named it the Heli-Vector. •



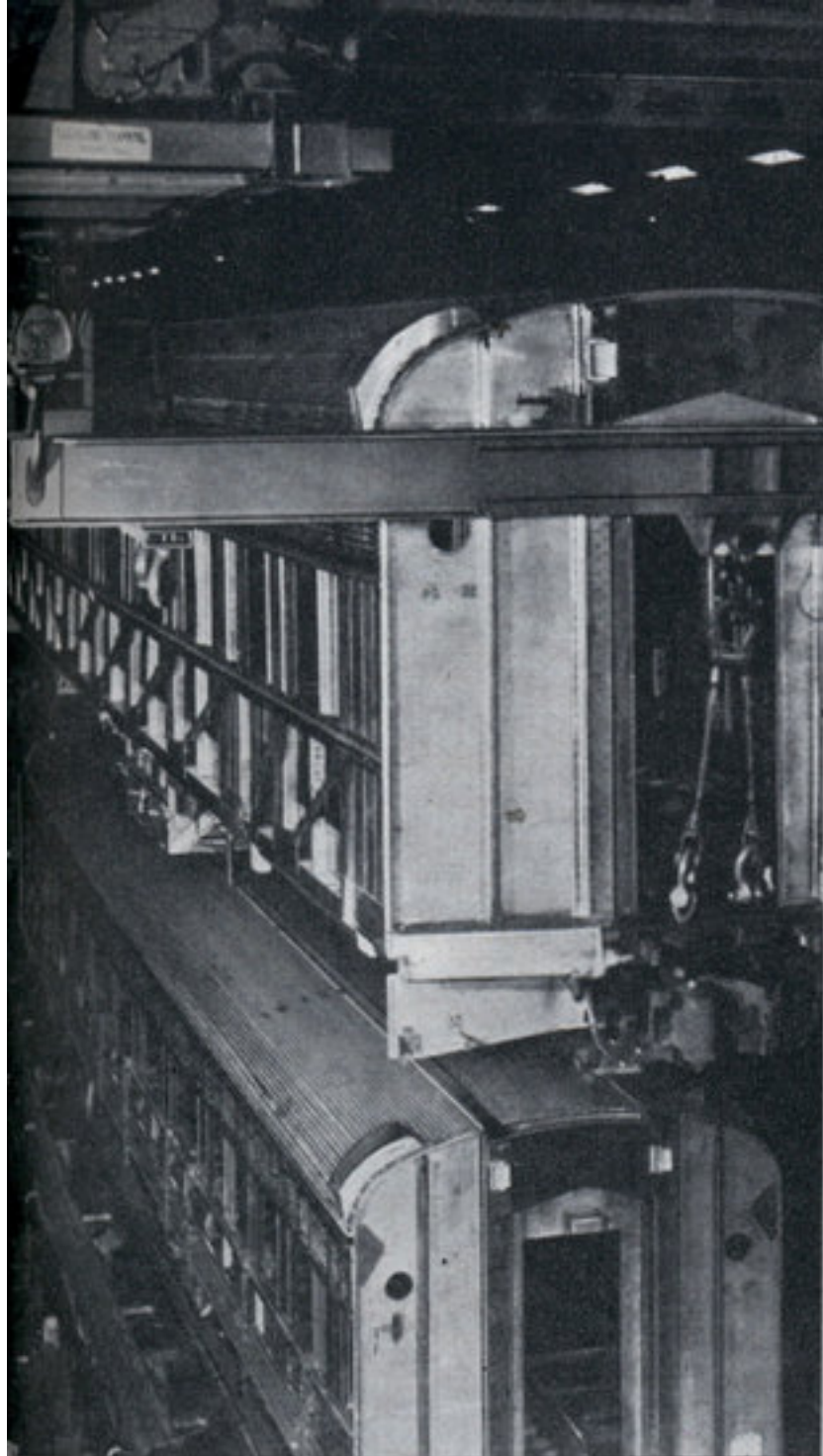
Inflated outrigger cushions protect rotors during landings, stabilize craft on water.

Ability to settle on water should be useful in forest, mountain and coastal areas.

Safety belt, foot fastenings keep copter jockey from falling through the big double fan.

Mercury racing outboard motor, liquid cooled, delivers 30 hp at 7,000 rpm.





Stitching Steel Into Streamliners

By MORTON C. WALLING

AS YOU stand on a catwalk high above the plant you can scarcely see where it ends, dim in the distance, five city blocks away. The workmen dwindle to mere specks, the gigantic U-shaped welders become tiny tweezers. Toward you stretch three long, silver caterpillars: assembly lines. Here and there comes a flicker of blue flame from an arc welder, reflected and reflected again from shining stainless steel. Occasionally there is a rumbling medley of thumps from shot welders; otherwise there is only a low hum from the thousands of workmen and machines.

Here is modern technology in action—the assembly-line system the auto industry made famous. But as the great cranes swoop down along the line and the silvery bodies roll nearer and nearer you can see they are too

**Budd's new assembly line
rolls out cars like cans.**

shiny for automobiles—and too big. Each is as long as half a dozen motor cars—a stainless steel railway coach.

For this is the plant of the Budd Company, where the high-speed step-by-step assembly techniques they have long used in making all-steel auto bodies are applied to railway cars. And the result will be a new standard of comfort in railway travel, at a reasonable cost. By the application of Detroit methods to Philadelphia, what starts out as stacked rolls of stainless steel, varying from 1/10 to 1/4 inch in thickness, emerges a short time later as a finished railroad car, ready to be towed out and put behind a locomotive. In between are some quarter-million shot welds, 200 rivets—and some highly intelligent engineering.

The first stainless steel train, the Chi-

STORY CONTINUED ON PAGE 126, FOLLOWING FOUR PAGES OF PICTURES

At right, and continued on the next three pages, is a panoramic view of the Budd shops. Covering 25 acres, they have enough open area for 50 regulation gridirons. Capacity is two \$85,000 coaches a day.

OVERHEAD CRANES MOVE HEAVY PARTS ALONG THE LINE

RIVETING UNDER-FRAMES TO A CENTER SILL

DRAW BENCHES FOR CORRUGATING ROOF AND SKIRT PANELS AND MAKING CENTER SILL PARTS

MULTIPLE-WELDING MACHINE MAKES CENTER SILLS

INSTALLATION OF ELECTRIC WIRING, SOUND PROOFING, AIR-CONDITIONING PARTS, AND INSULATION IN ROOFS

FRAMING A ROOF

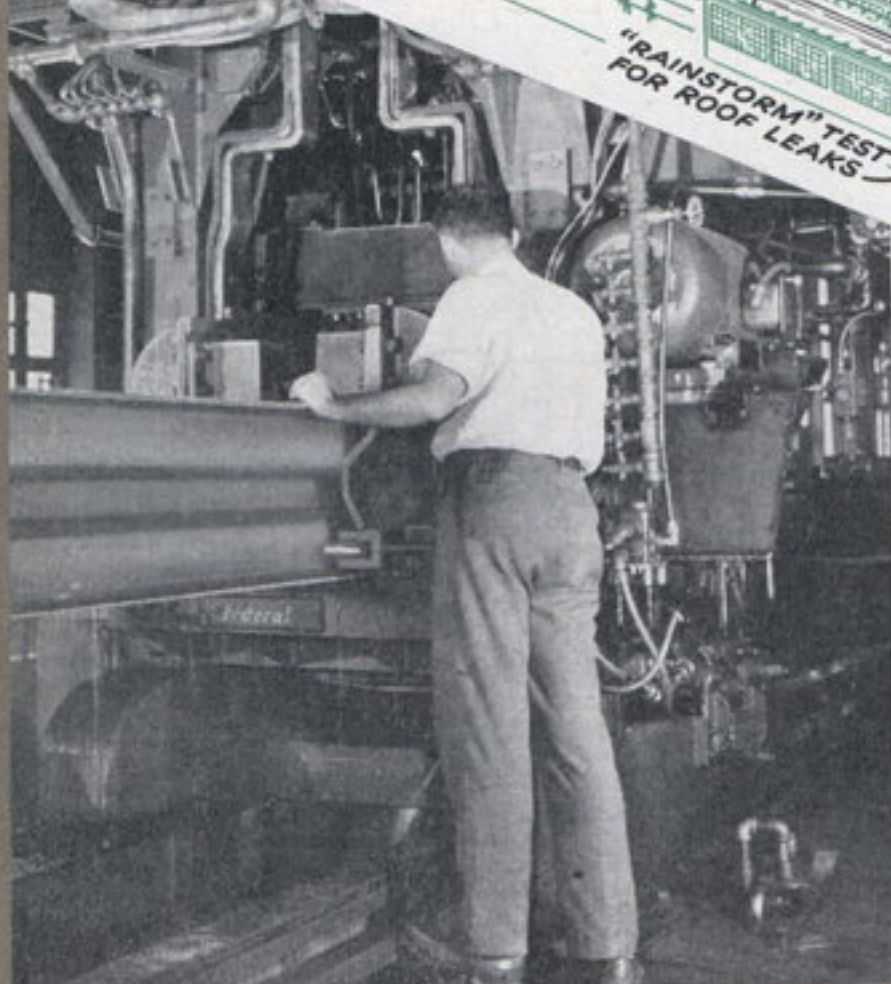
SHEATHING A ROOF

SUBASSEMBLY LINE COMES IN HERE

FLOOR MAKING

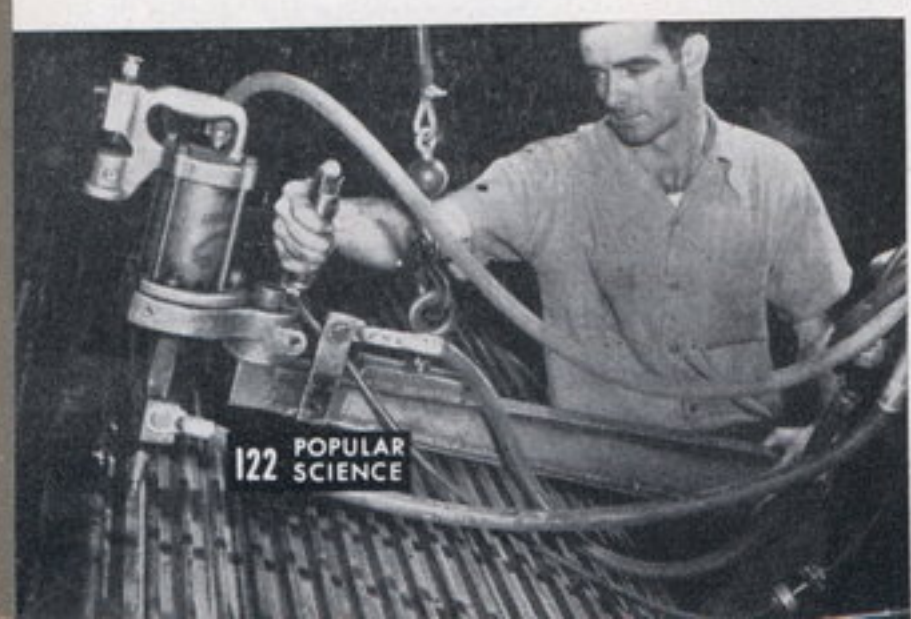
"RAINSTORM" TEST FOR ROOF LEAKS

SIDE-FRAME PARTS CLAMPED IN JIG AND WELDED



Above, a "walking welder" that in half a day joins the four 58-foot sections of the center-sill beam. With hand methods, job took a week.

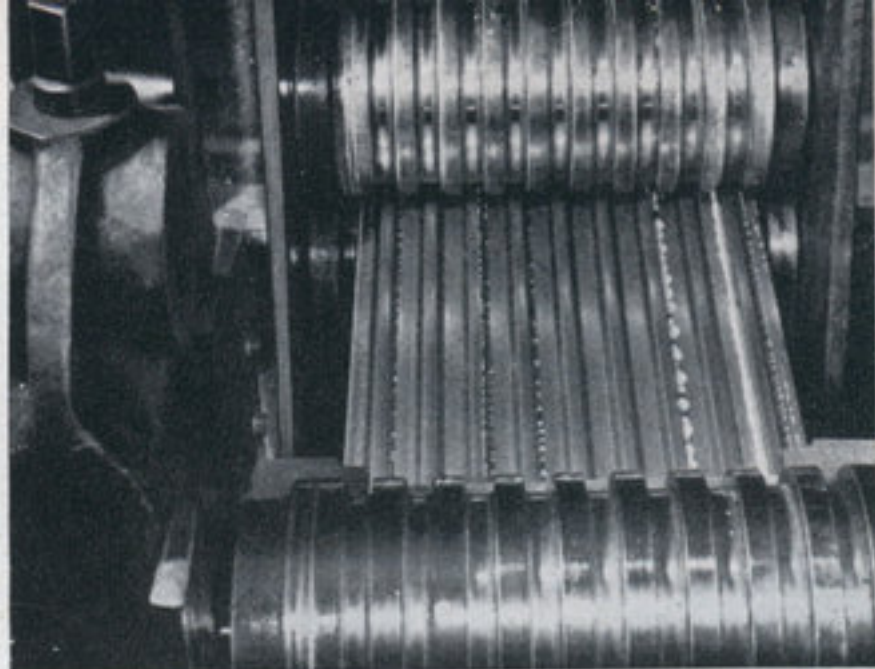
Inside of a car is sprayed with insulating material. Fiberglass batts will be added later.



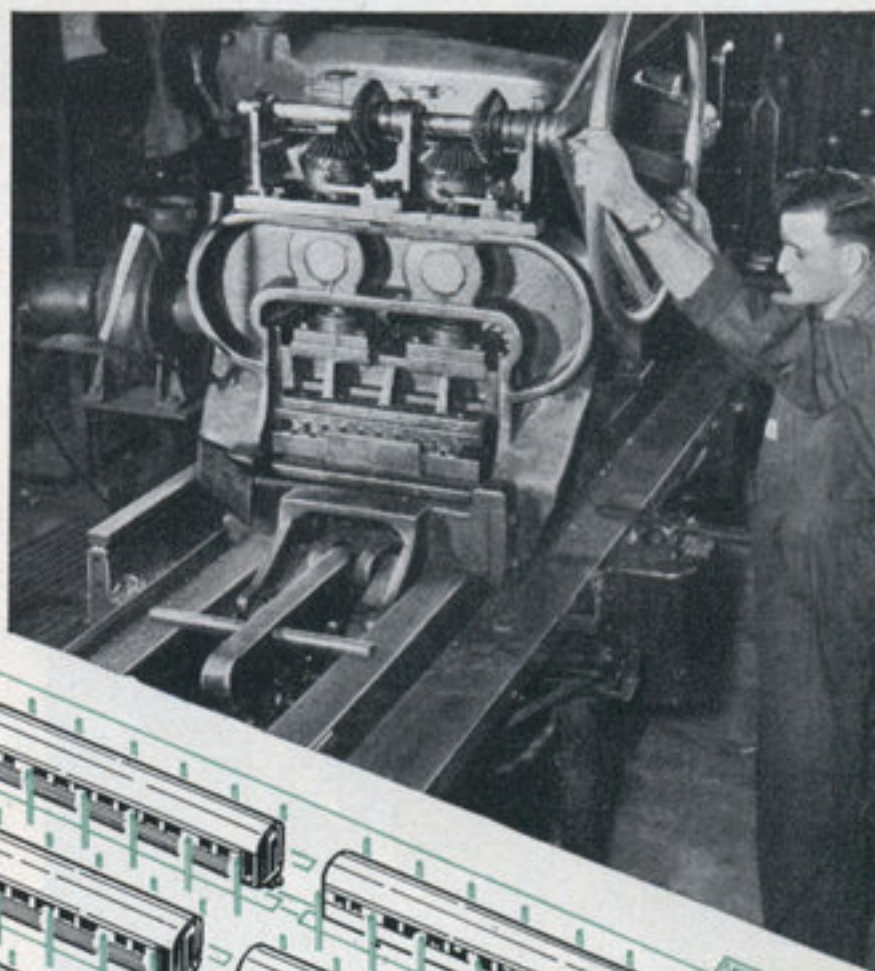
At left, a button is pushed and the shot welder fixes roof panels in place. Roof is assembled right side up, inverted for more installations.



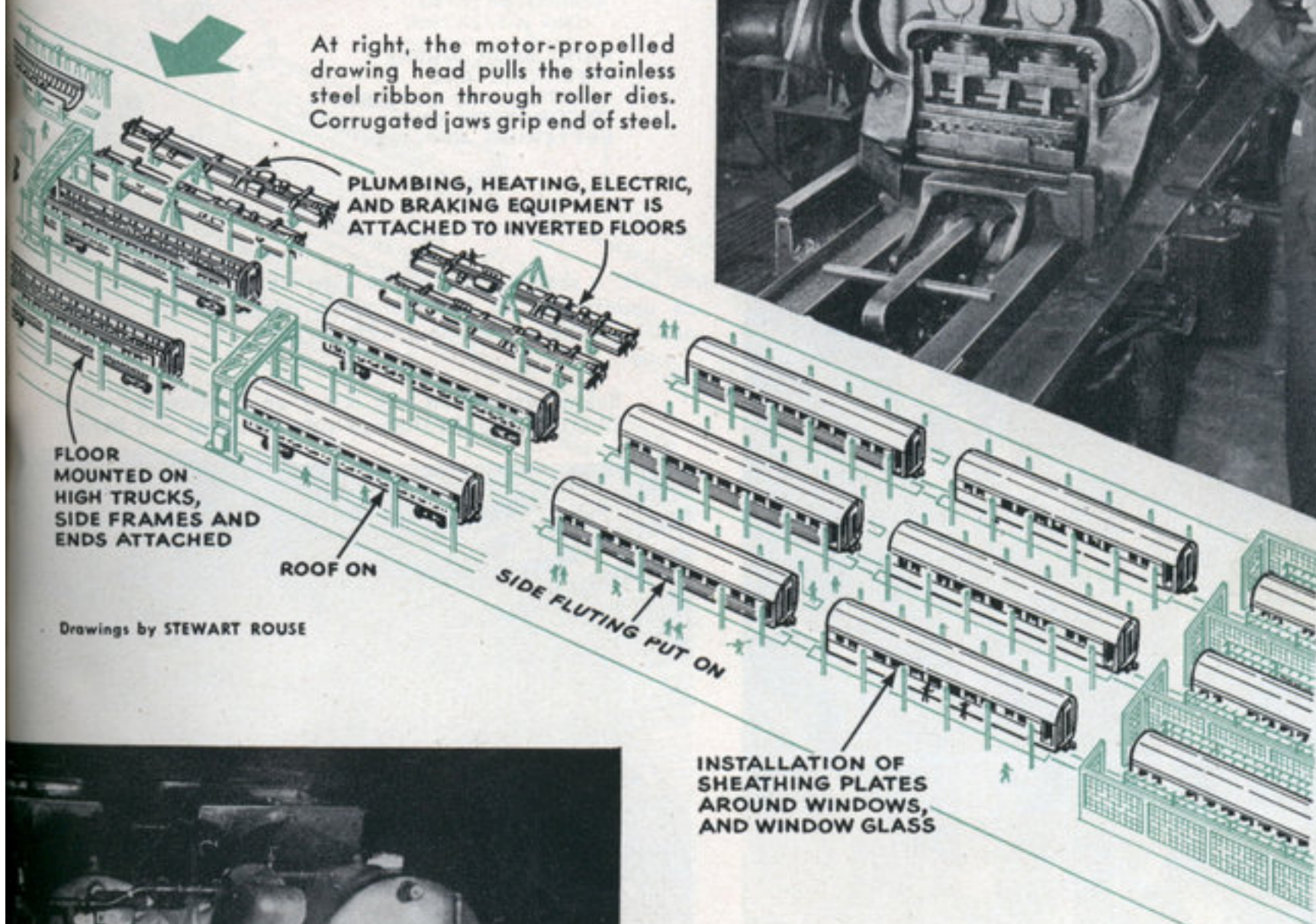
Above, the drawing bench puts wrinkles in stainless steel roof and side panels. A similar bench forms sections that make center sill, or car backbone.



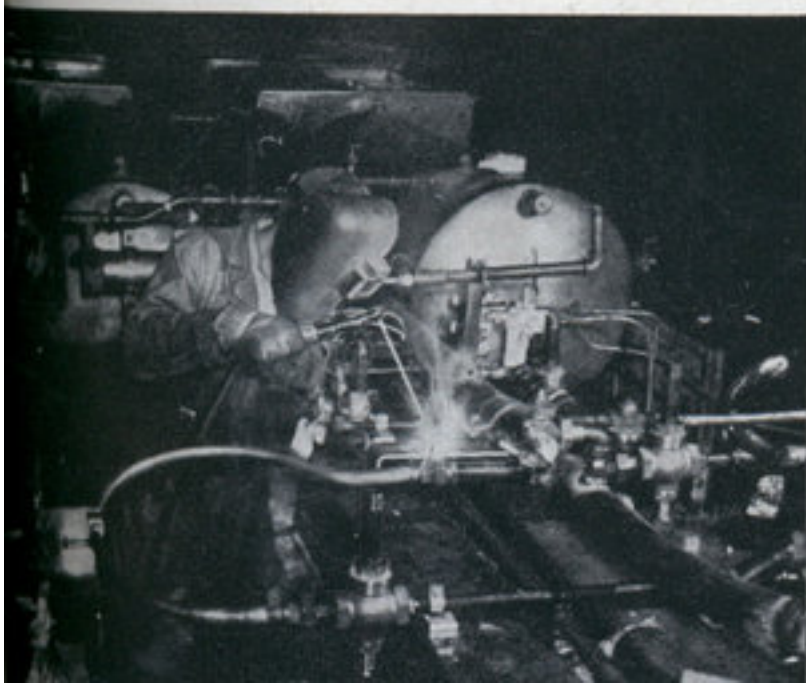
Roller dies above are the super-tough wringers that actually wrinkle the metal. Part of the drawing bench. Each costs as much as \$5,000.



At right, the motor-propelled drawing head pulls the stainless steel ribbon through roller dies. Corrugated jaws grip end of steel.



Drawings by STEWART ROUSE



At left, underframe is upside down for installation of auxiliary equipment such as air brakes, heaters, plumbing. Arc welding does the job.

"RAINSTORM" TEST FOR LEAKS
The final water-test chamber, right, reproduces 80-m.p.h. trip in driving rain.

WALLS INSULATED; LOUNGE FRAMEWORK, CEILING & WALL PANELS PUT UP

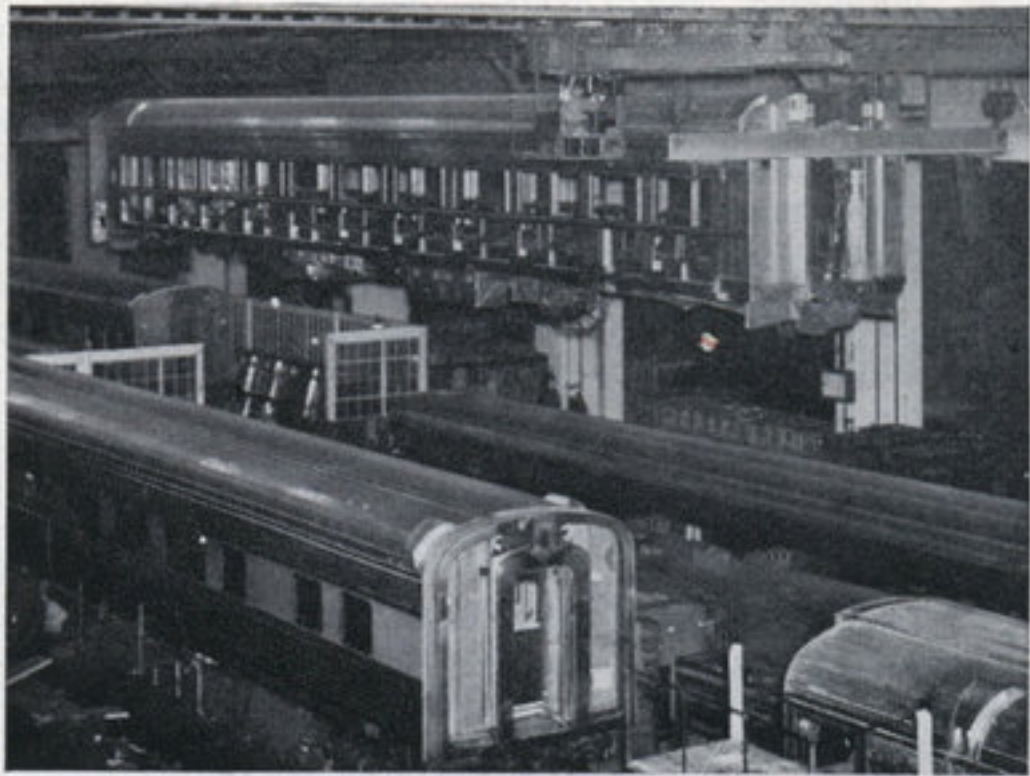
DOORS ARE HUNG; LOUNGE WALLS PUT UP; LUGGAGE RACKS, LIGHTING FIXTURES, AND SOME HARDWARE PUT IN

PAINT SHOP, WHERE INTERIORS ARE PAINTED, AND OUTSIDE DECORATION AND LETTERING APPLIED

Above, a workman tightens window screws to stop leak discovered during water test.

At left, a shot welder joins a side frame to an underframe at the first main assembly position, where skeleton car is formed.

Below, assembled car is set on temporary, raised trucks for application of side paneling and fluting.



LOW, PERMANENT TRUCKS
INSTALLED; END DIAPHRAGM
PLATES ATTACHED;
LINOLEUM WALLS AND
FLOORS APPLIED

LINOLEUM WORK
COMPLETED AND
SEATS PUT IN

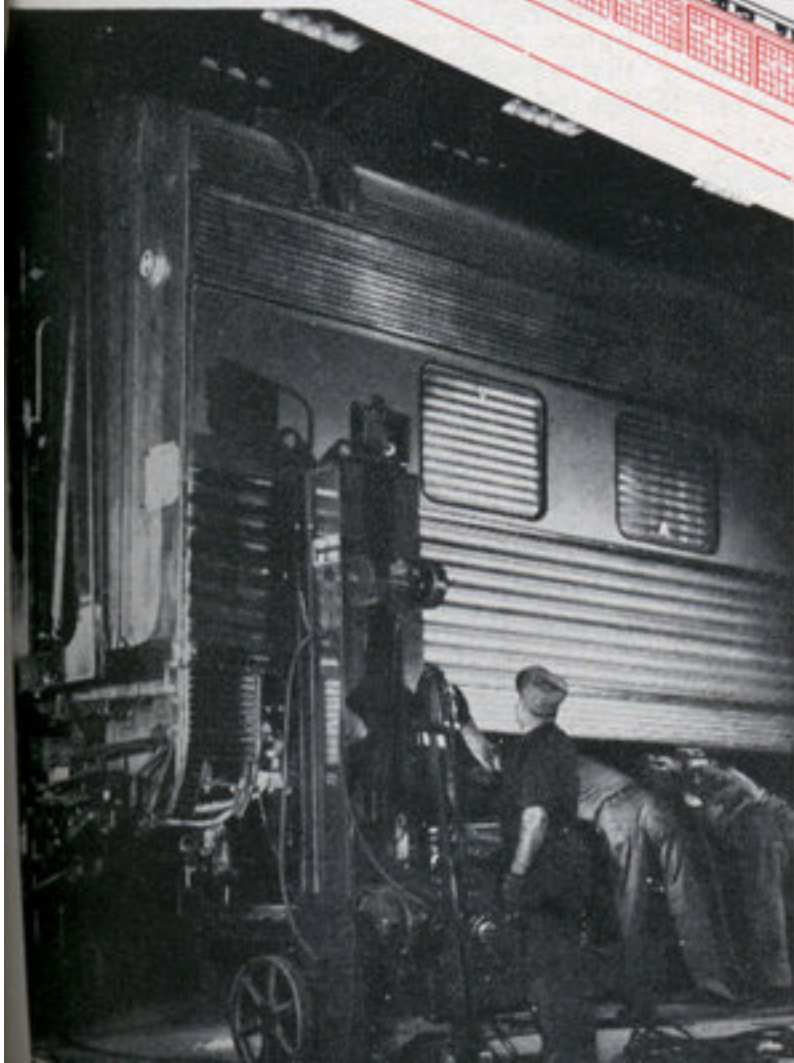
SUBASSEMBLY
LINE ENTERS
HERE

PRELIMINARY
AND FINAL
AIR-CONDITIONING
TESTS; MOLDINGS
INSTALLED, AND
FINE FINISHING
COMPLETED

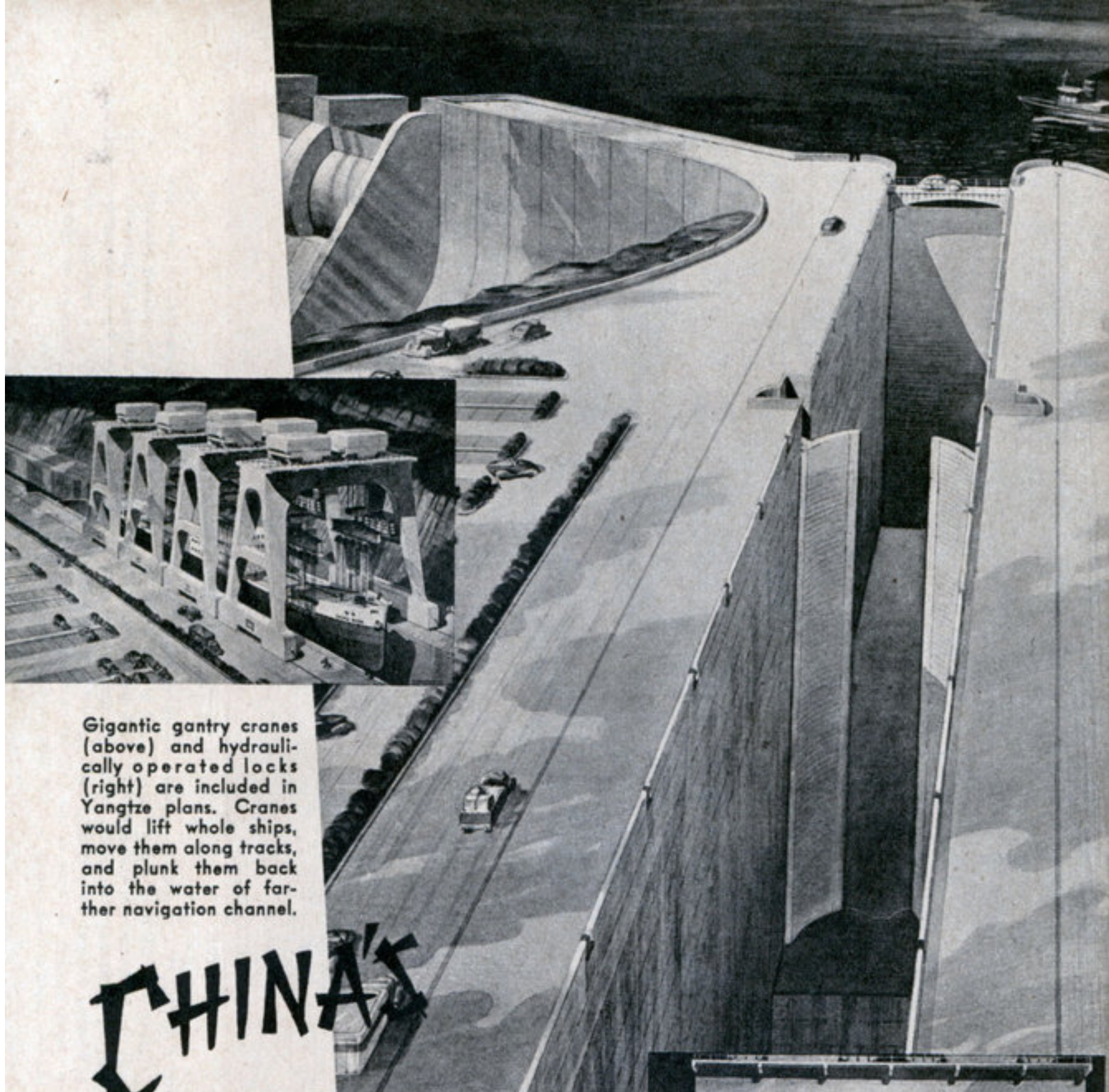
A partly assembled car being swung into posi-
tion along the production line. Four 10-ton over-
head cranes do all the heavy lifting as the
stainless steel cars move toward completion.

FINAL
INSPECTION

FINISHED CAR
READY FOR
DELIVERY TO A
RAILROAD COMPANY



At left, the permanent trucks are being installed. Heavy-duty jacks are used to raise the cars into the required position for the job.

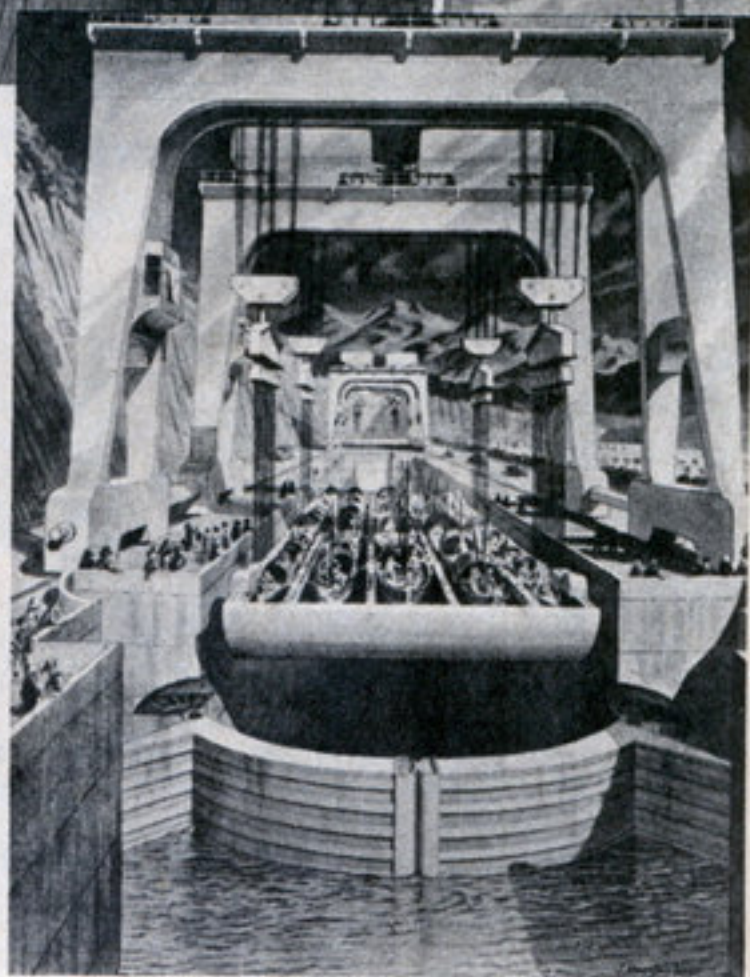


Gigantic gantry cranes (above) and hydraulically operated locks (right) are included in Yangtze plans. Cranes would lift whole ships, move them along tracks, and plunk them back into the water of farther navigation channel.

CHINA'S DREAM DAM

BIGGEST irrigation, power, and flood-control dam on earth is projected for China's Yangtze River about 300 miles east of Chungking. Dam will impound water to irrigate 10,000,000 acres. Hydroelectric plant will generate three times power of Boulder, Grand Coulee and Shasta plants combined. U. S. is helping China's National Resources Commission with plans.

Gantry cranes that may be used to get ships past the Yangtze Gorge dam would lift or lower them 550 feet. Dozens of sampans would be handled at once in a corrugated boat tank. Hulls of large vessels would have to be reinforced.



Apple's Flavor Squeezed Into New Delicacies



Natural flavor extracted from the apple gives these products the tang of orchard-fresh fruit.

How scientists solved the problem of the apple's lost flavor and then captured its essence in a bottle.

By John P. Arnold

IF YOU must have your apple a day, you can now enjoy it in a variety of forms. A new method of extracting pure apple essence from the fresh fruit has brought the

flavor and aroma of the ripened McIntosh or Red Delicious to candies, ice cream, soda pop, gelatin desserts, and many other home-made and commercial products.

And if current experiments are any indication, you'll soon be able to chew your apple in chewing gum, inhale it in cigarettes, smell it in perfume, or enjoy its taste in apple-flavored medicines.

It all stems from the apple industry's

problem of producing a concentrated apple juice that would keep for year-round sale and still have the flavor of fresh cider, which is perishable. Processors had learned that by adding an enzyme, Pectinol A, they were able to break down the pectin that causes gelling. Thus they produced an apple juice of about 75 percent solids; it had excellent keeping qualities and could be shipped in tank cars without special precautions. But, unfortunately, the processing robbed the

juice of most of its flavor, and it couldn't compete with fresh apple cider.

When the processors tossed their problem into the collective lap of Department of Agriculture scientists, the latter had a theoretical, but wholly logical, answer: extract the flavor from the fresh apple; process the fruit; put the flavor back in again.

"Yeah, brother, but how do that?" was the wail. "Don't know, but let's try," the scientists replied. So an experimental sta-

EVAPORATING APPARATUS
FOR PRODUCING
CONCENTRATED
APPLE JUICE

HOLDING TANK

STRIPPED
JUICE
TANK

ESSENCE
RECOVERY
UNIT

GRINDER

ELEVATOR

FILTER PRESS

INVERTED
HYDRAULIC RAM

CIDER PRESS

The natural apple flavor is extracted by the center unit of this U. S. Department of Agriculture experimental installation at Wyndmoor, Pa. Juice concentrator is at left.

tion was set up at the department's Eastern Regional Research Laboratories, at Wyndmoor, Pa. There, for several years, the apple has been given such a thorough going over that it has fewer secrets than a presidential candidate.

After much trial and error, the researchers hit on a way of capturing the sources of the natural apple flavor, located for the greater part just under the skin. The process consists of first heating the juice of pressed apples to volatilize the flavoring elements. Then the vapor is mechanically separated from the juice, concentrated by fractional distillation, and condensed.

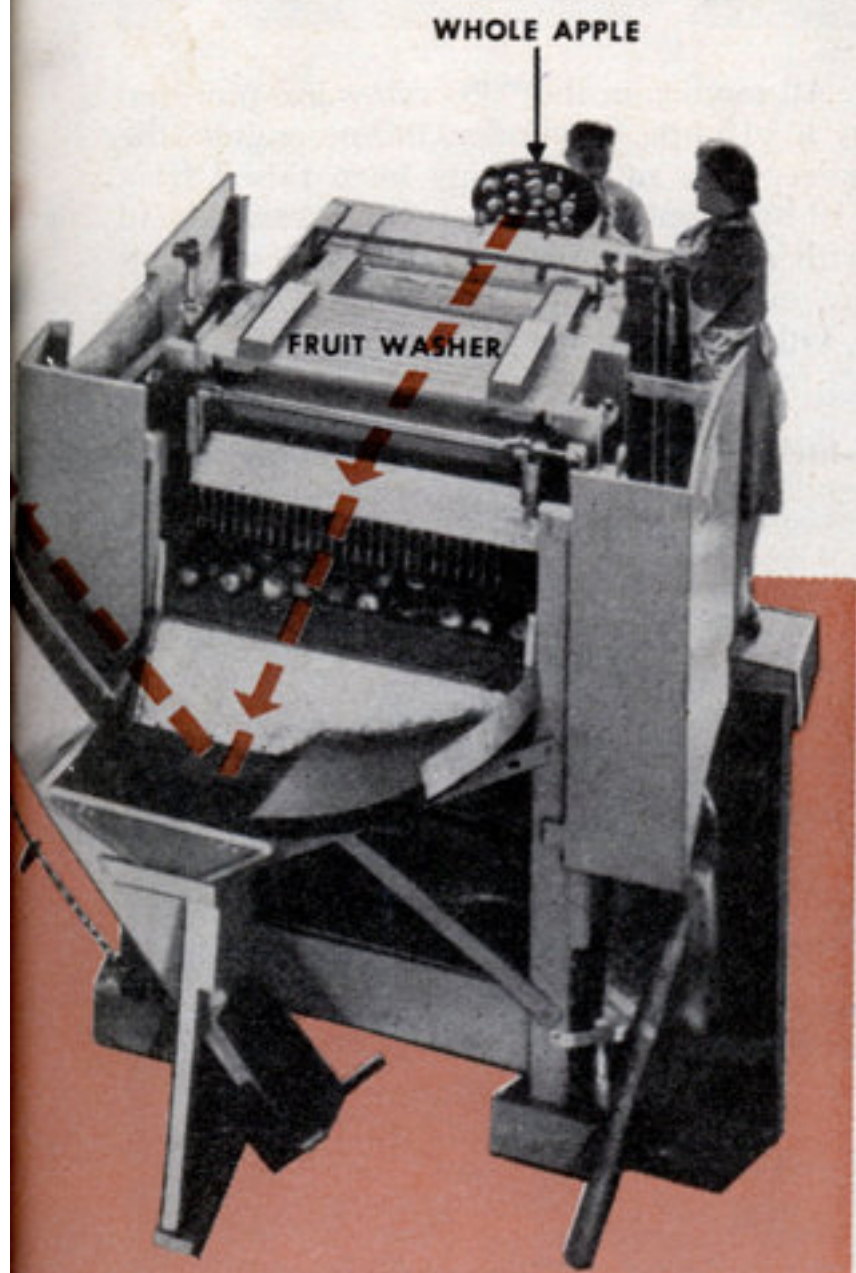
The result is a clear, colorless liquid, a 150-fold concentration of the juices from which it is extracted. And the stuff is so powerful that a few drops released in a room carry you right back to the old orchard.

This separation of the apple flavor has been a shot in the arm for the apple industry. The essence is first recovered from the fruit. The juices are then concentrated and

reflavored with the essence, with the result that there is no apparent difference between the processed product and apple cider fresh from the presses. Another advantage is that peelings and other parts of the apple, often waste products, can now be used. Also, apples of inferior flavor can be squeezed for juice-making and then spiked with the essence of the more desirable varieties.

Six companies already are selling the essence, and 60 others are installing the equipment for making their own products. Other fruits and berries are also in line to have the juice knocked out of them.

Since its extraction, the new essence has found many other uses outside the apple industry. Perfume-makers are experimenting with it. Research chemists say it may serve as a bait for insect poisons and as a mask for the nasty taste of castor oil and other medicines. The housewife will soon have a bottle of it on her kitchen shelf to flavor a dish of ice cream or a gelatin mix. Since the day of the Big Apple, this fruit has never had such a big moment. **END**

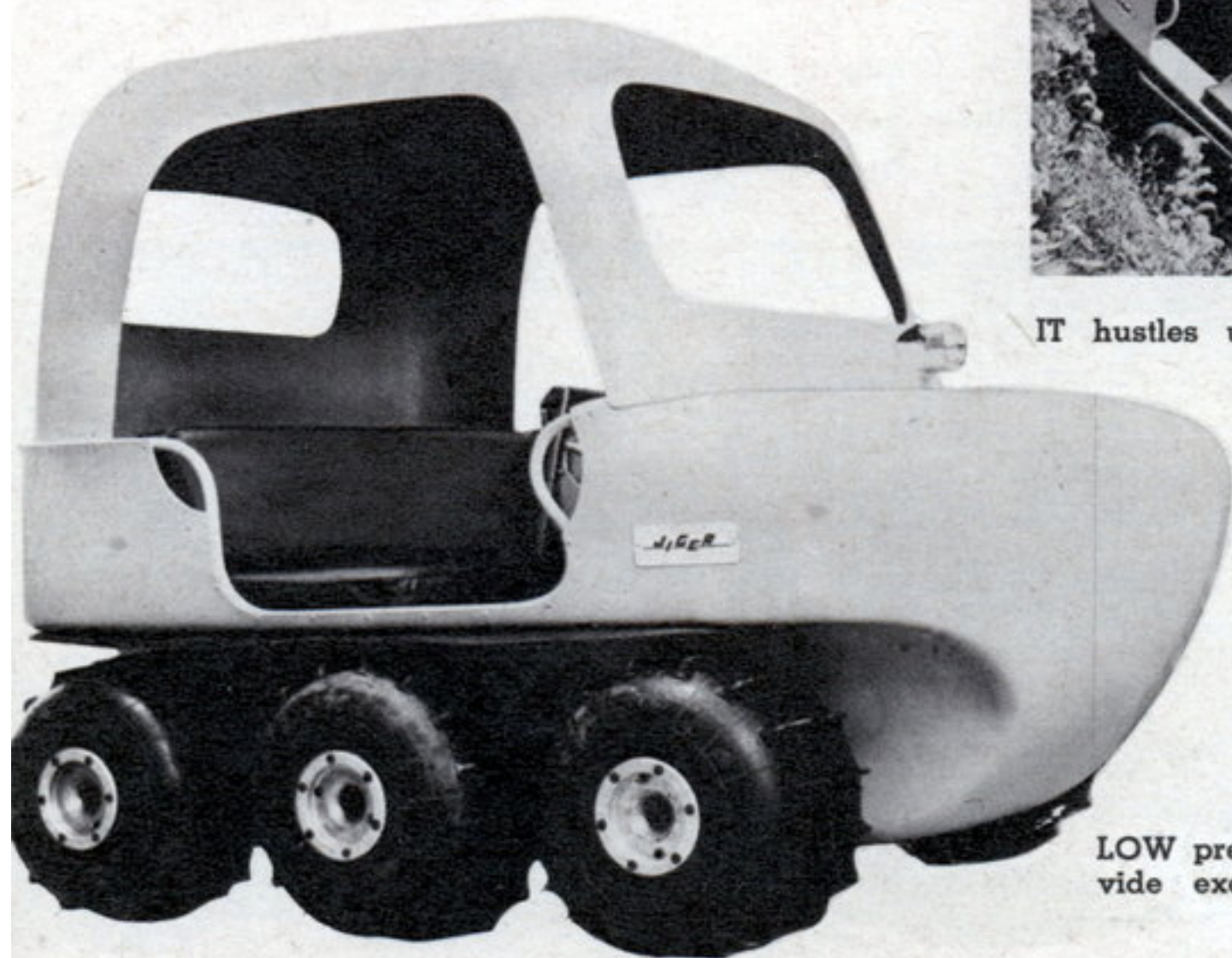


Horse Laughs at Ice

ICE in his water trough doesn't bother the horse whose master has installed the Westinghouse heating disk shown above. A round piece of metal, it contains a 500-watt heating element giving off enough heat to keep the water ice-free. It costs less than five cents a day to operate.

CARS

YOU'D LIKE TO OWN



IT hustles up hills easily.

LOW pressure tires provide excellent traction.

GO-EVERYWHERE HUNTING WAGON



CONTROL STICK combines airplane-type joy stick with motorcycle twist controls.

JIGER (pronounced jigger) is the creation of inventor John Gower of Toronto, Canada. It's a six-wheeled, fiber glass-bodied, hell-'n'-high-water-bug that should strike the fancy of many an outdoorsman. Two 5½-hp engines



JIGER makes a dandy mobile duck blind. The wagon will be marketed for about \$895.

drive Jiger overland at 30 mph. A pair of props recessed in the "stern" push it through the water. Hardly anything, in fact, can bar this spunky 200-lb. two-seater from your favorite hunting or fishing grounds.—Gordon McCaffrey

CARS

YOU'D LIKE TO OWN



VON DWINGELO with award-winning T-Bird.

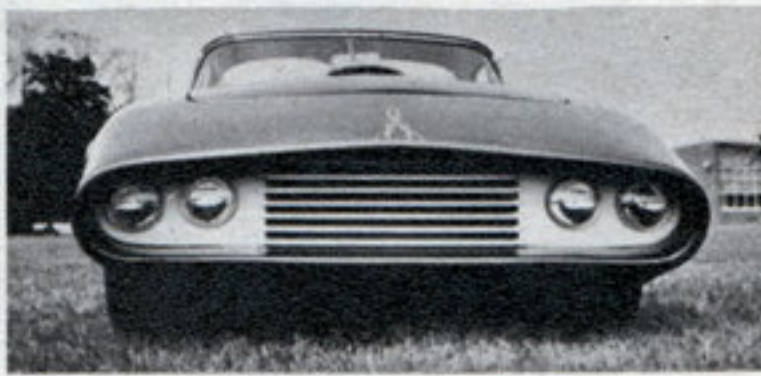
CAN THIS



DASH boasts tachometer and radiophone.



OLDS mill sprouts six Stromberg carbs.

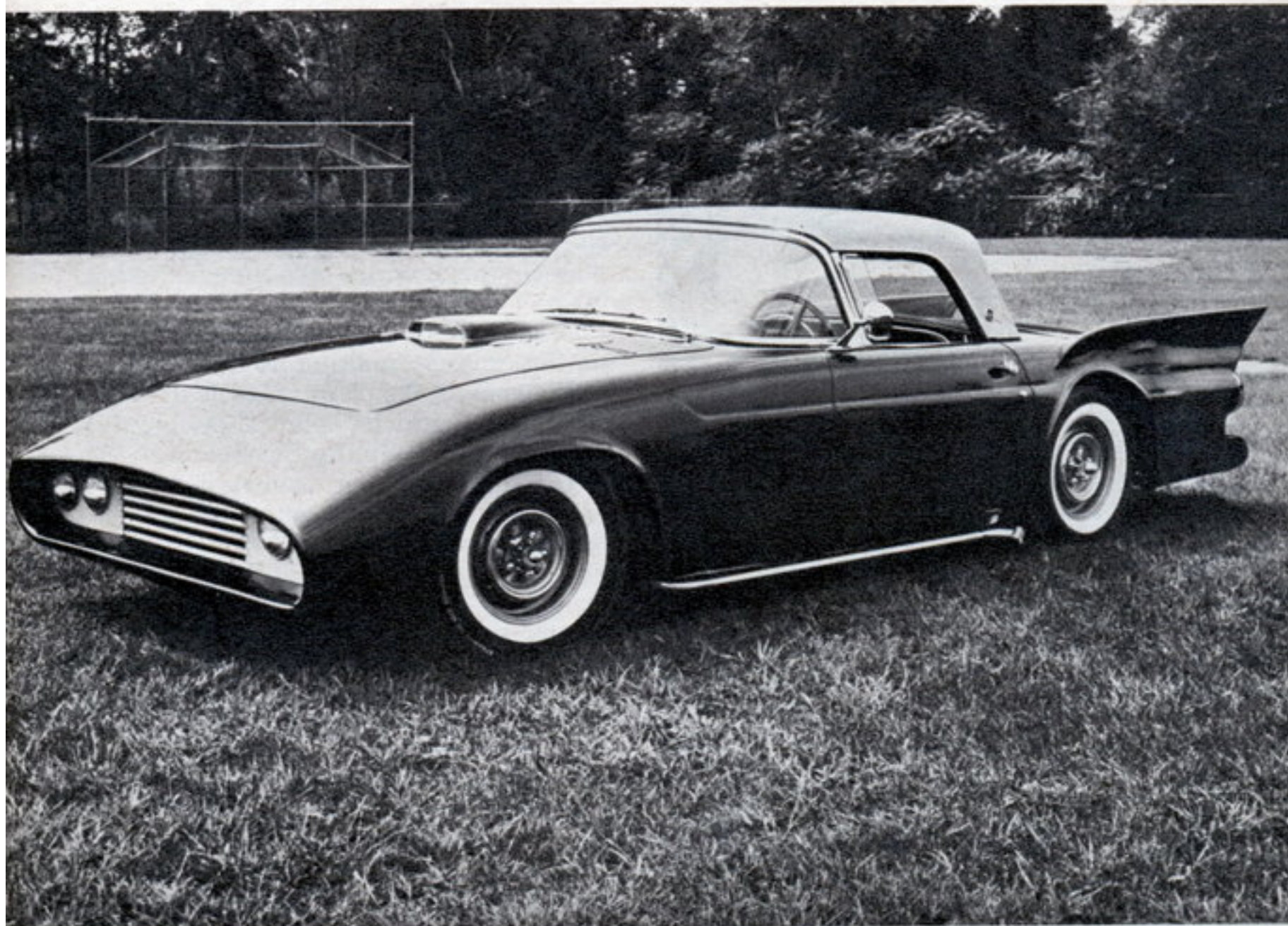


LAMPS from '60 Chevy flank louvered grille.

FINNY stern shows six exhausts and Dart taillights. ➡



BE A THUNDERBIRD?



CUSTOMIZED T-Bird does flying mile at 164 mph; standing quarter-mile in 12.4 seconds.

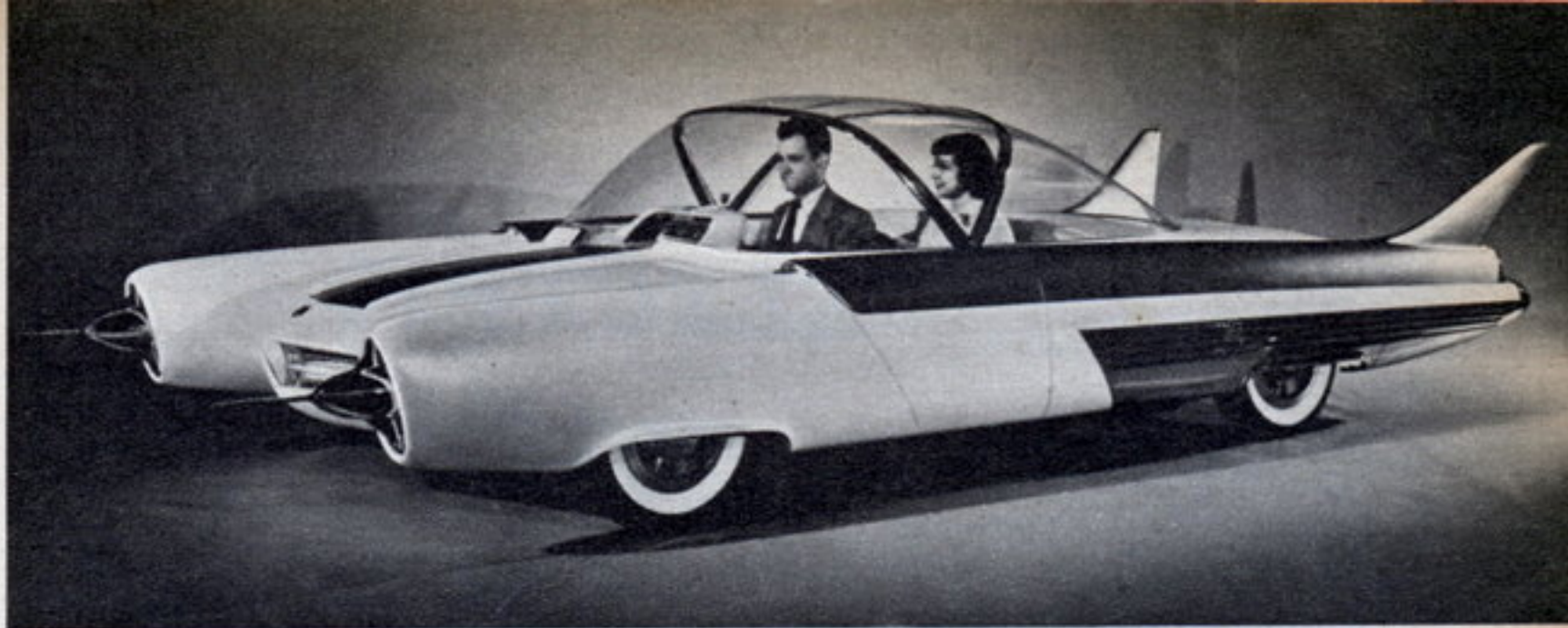
THIS totally customized 1956 Thunderbird has won more than 182 trophies in car shows throughout the United States and Puerto Rico. The rebuilding job was done by owner Don Von Dwingelo of Paramus, N. J. and Tony Bruskivage of Hawthorne, N. J.

The body glows with 16 coats of red lacquer; the hardtop is cream speckled with gold. Dual headlamps from a 1960 Chevy beam from oval-hooded grille.

The richly upholstered interior features black Naugahyde seats and a black, piled rug flecked with gold dust. The dash sports Stewart & Warner gauges and a white radiotelephone.

Power for this rocket derives from a 1958, 461-cubic-inch Olds engine that answers to a competition stick shift.

Von Dwingelo is reluctant to put a value on his 'Bird but he's insured it for \$15,000!—*Rudy Arnold*

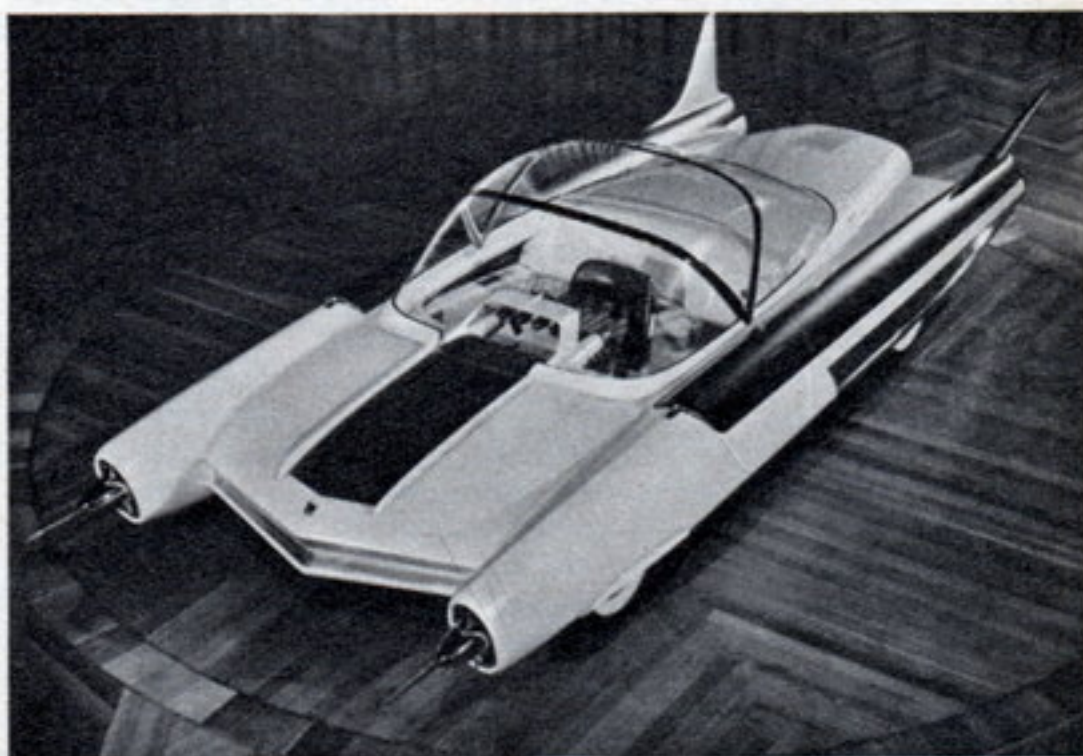


Meet the FORD ATMOS

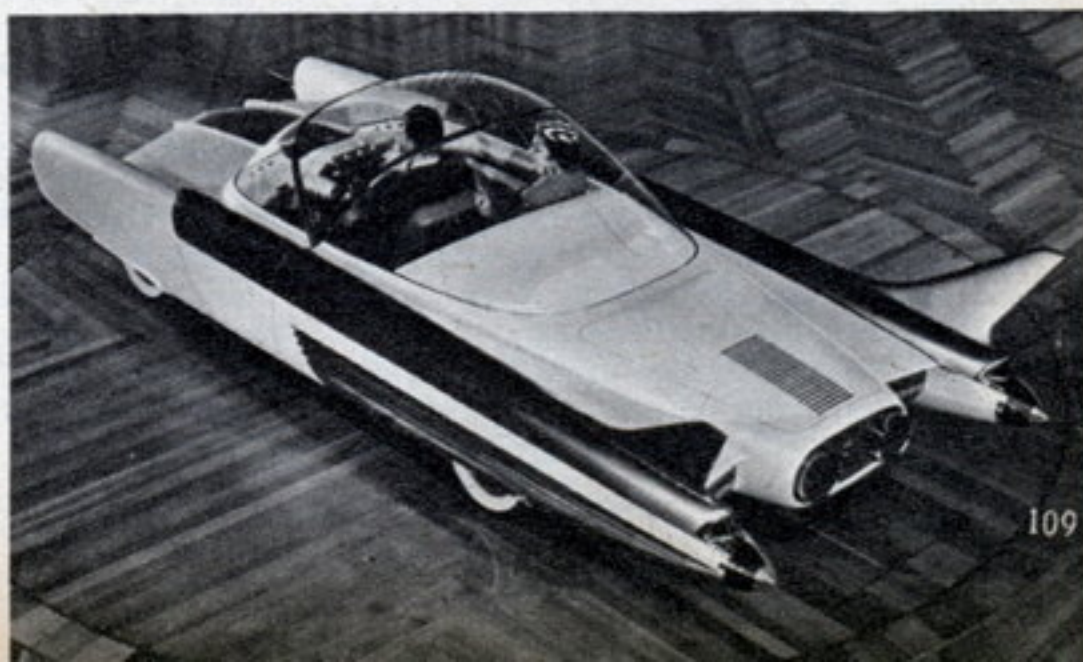
ONE of the wildest "dream" cars ever to roll out of a Michigan experimental laboratory is the creature shown above, the FX-Atmos—built by Ford and backed up by the determination that "it shall never be built for sale." This, say the engineers, is purely a "car of the future," however

it represents styling concepts that could easily appear in the Fords of a few years from now, if the general public accepts them. The engine design and other mechanical factors were not included in this project. Wheelbase is 105 inches; length: 220.58 inches; height: 48.1 inches. •

Overhead view of the Atmos shows the central location of the driver's seat, with two passenger seats beside and slightly to the rear of driver. The body is plastic.



Vehicle is steered by means of handgrips which control the power steering unit. All-around visibility is provided under the air-conditioned plastic canopy of dream car.



Built outside cities, these igloo-style homes would give slum dwellers low-cost and efficient housing. On the opposite page is the designer's conception of how such a suburban street might look. The windows, doors, and connecting hallways may be located wherever owner wishes



Would you Live in a STAINLESS-STEEL IGLOO?

These heavily insulated steel shells are a new approach to the housing problem. Low in cost and portable, they give a wide flexibility of layout.

By
FRANK ROWSOME, Jr.

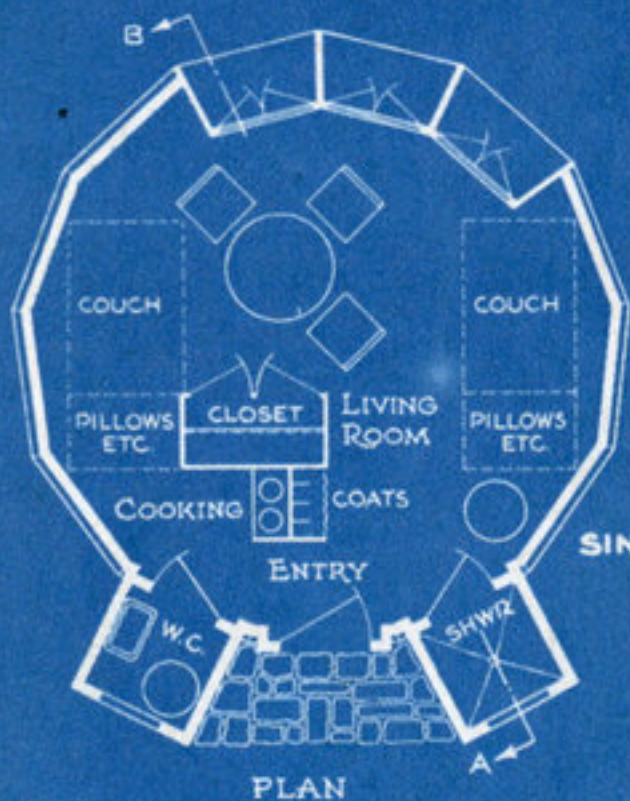
YOU can't make an electric light just by perfecting a wax candle." So says Martin Wagner, Harvard professor and internationally known architect, in explaining how he conceived the unique igloolike houses shown on these pages.

Most modern prefabricated houses, Wagner asserts, are at the same stage of development that automobiles had reached when their builders were trying to make them look like buggies. In his opinion, a steel, plywood, and plastic house that is produced in a factory should not merely

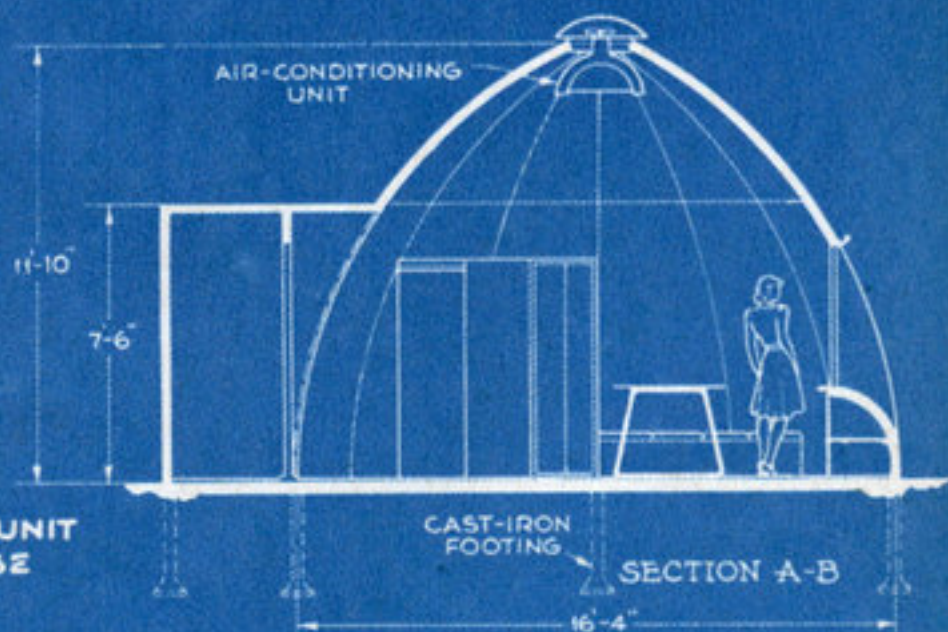
imitate wooden, carpenter-built houses. Instead, it should make full use, in form as well as construction, of new materials and new techniques.

In his design every room is a house in itself, connected with another room by a short hall. Each 13-sided unit is made of steel-sheathed plywood, liberally insulated with glass wool. Because a structure of conoidal shape is from an engineering viewpoint already in a "state of collapse," the house is practically proof against hurricane and earthquake. Built into the apex of each room is electrical heating and ventilating equipment, permitting individual control in every unit. While in an ordinary house some 15 or 20 tons of building material have to be heated or cooled for each room, it's necessary to heat or cool only three tons for one of the igloo units.

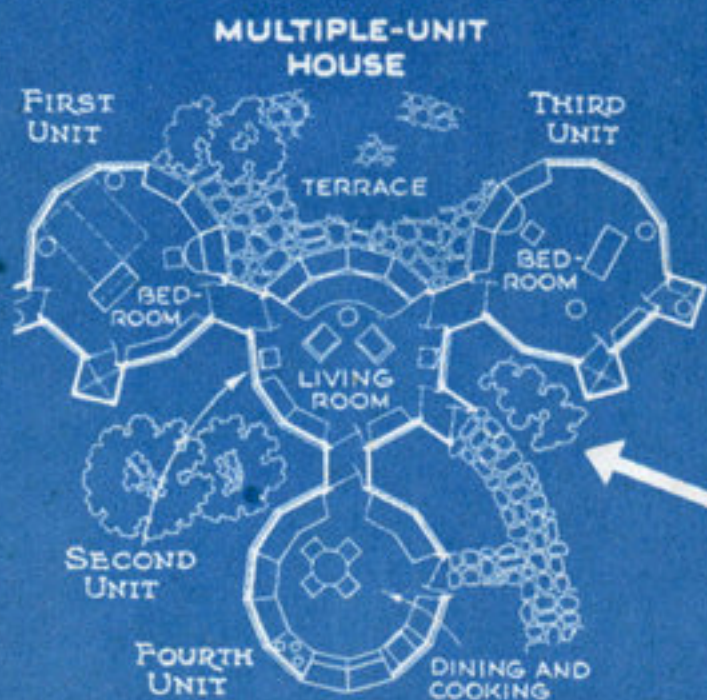
As visualized by the architect, a young couple might begin with a single basic unit which under mass production could be delivered and assembled, complete with shower and bathroom cubicles, for an estimated \$670. As they could afford it, regular bedroom, kitchen, bathroom, and study units could be added. Later on, if the family decreased in size, unneeded rooms could be sold. For moving, disassembly of a unit would require only eight hours.



SINGLE-UNIT HOUSE



One unit serves as a livable though cramped house. As other rooms are added, the owner can tailor his home to his needs





You don't believe it? These Parisians seem skeptical, too. The metal plate is actually floating in the air

PARIS has its flying saucer, but it is called "The Magic Plate." It is a two-pound aluminum disk that floats in air without apparent support.

It moves up and down. It rotates. It lifts an ornate chandelier with bulbs burning continuously as it spins. If such trickery doesn't prove that the plate is magic, it will fry eggs to a golden brown with nothing between it and the table but air!

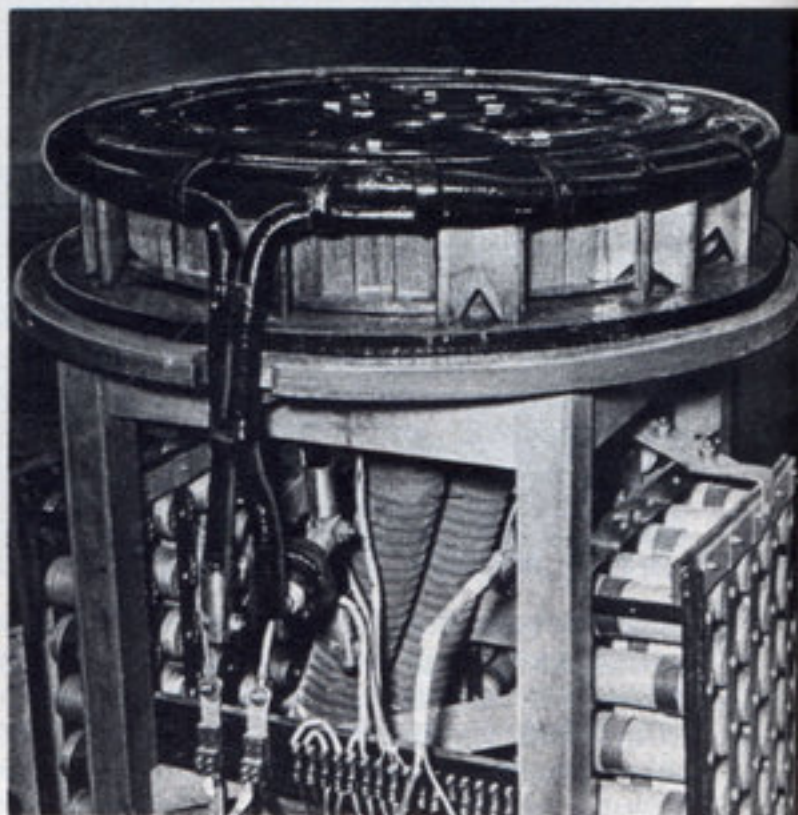
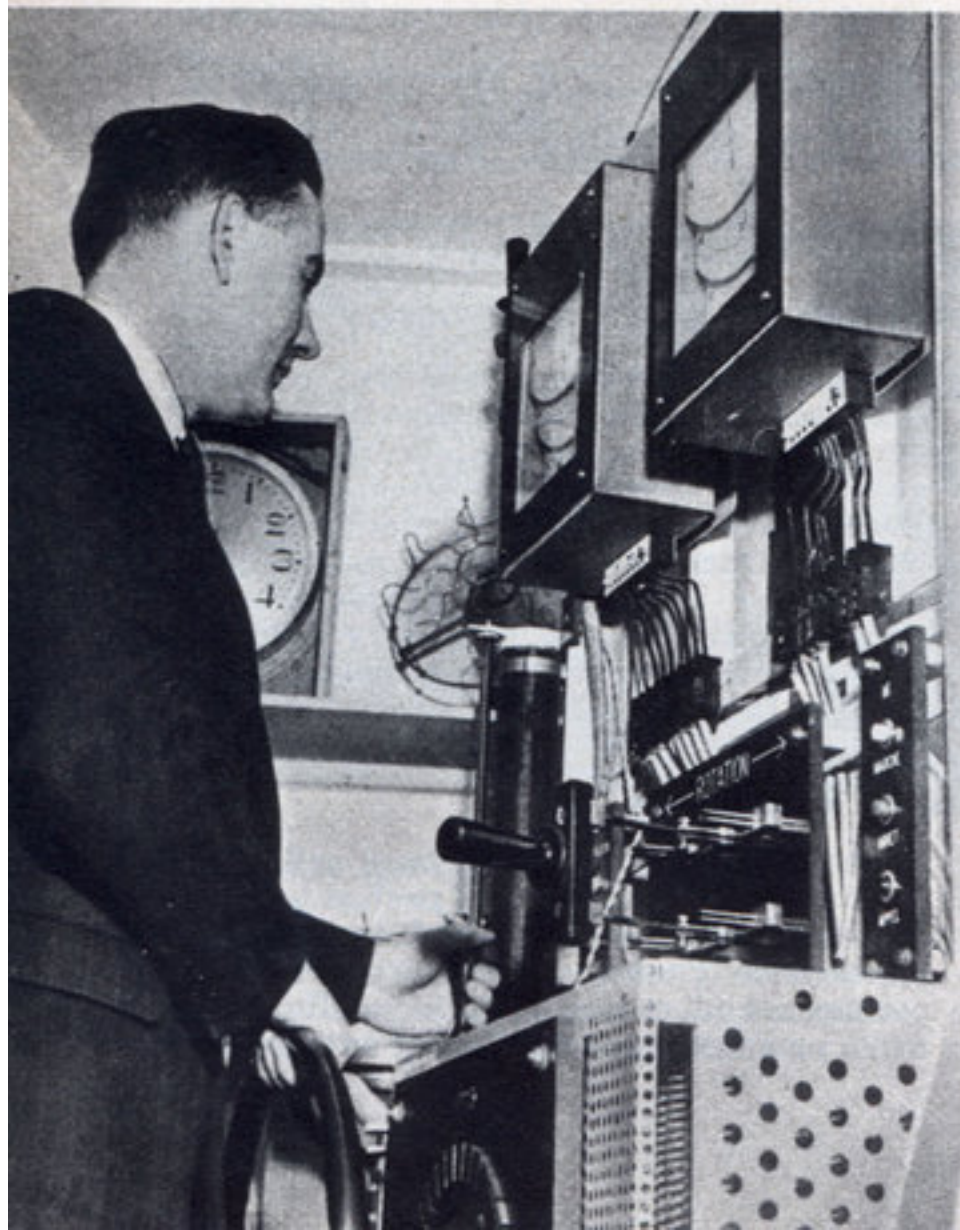
LOOK! IT'S

Actually, of course, it is no more "magical" than the magic of electricity and the phenomenon of induction.

Below the plate, concealed in the table, are two concentric coils. The inner coil sets

Left, it takes all these controls to make the plate perform by regulating the current entering the coils

Below, inside the table or pedestal above which the plate hovers is a complex maze of metal and wiring





Like your eggs fried lightly? These are so light they fly! Magnetic fields heat plate enough to fry the eggs

FLYING DISKS AGAIN!

up a magnetic field that repels the tray, forcing it into the air. To keep the tray from slipping sideways out of the lifting field, a large outer coil is used. This develops a conical field, tapering toward the top, to keep the plate centered.

A third field makes the disk rotate. Four coils create it. Once the tray starts spinning, it does so for a long period even after the rotation coils are turned off because

the drag of friction is almost nonexistent.

The chandelier weighs one pound. Its bulbs are lighted by induced current. The aluminum tray gets hotter than an ordinary electric iron, providing ample heat for egg frying.

What's it all for? It is strictly a stunt used in Parisian store windows to attract customers and impress them with the magic of electricity.

Best trick the "magical" plate does is to rotate a chandelier in air, its bulbs burning by induced current



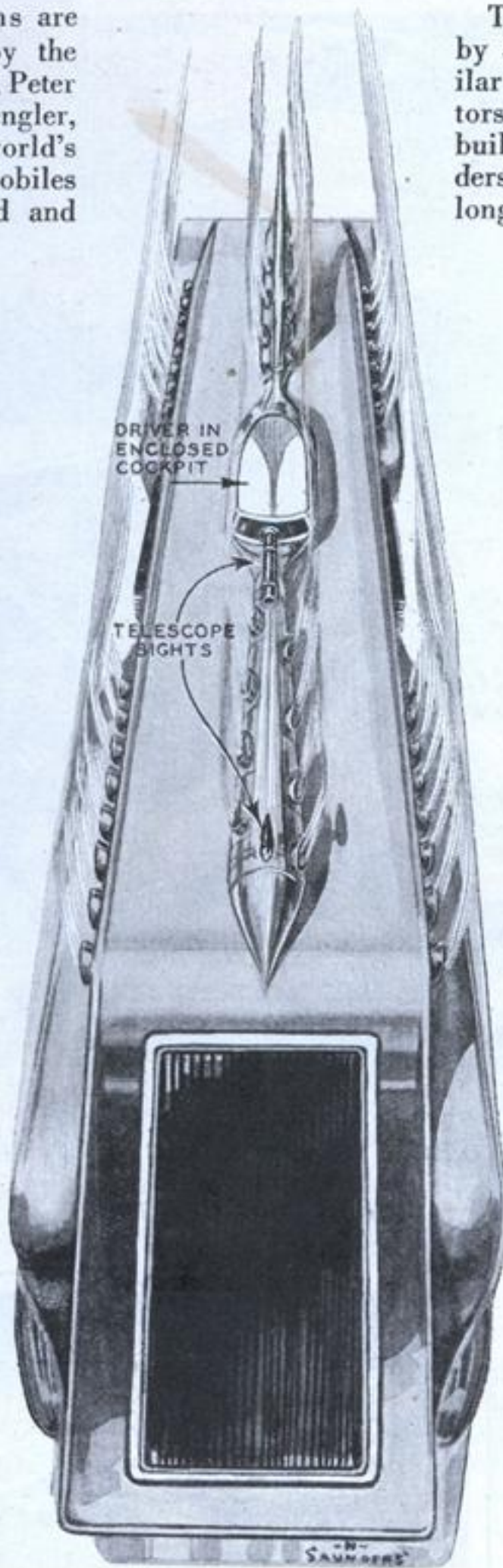
HUGE Race CAR to Try

ACTIVE preparations are now being made by the well-known racing drivers, Peter De Paolo and Harlan Fengler, to restore to America the world's speed record for automobiles now claimed by England and established by the late Major Segrave in 1929 at Daytona Beach, Florida. The present record stands at 231.36 miles an hour. Two Americans, Frank Lockhart and Lee Bible, have lost their lives on the sands of Daytona Beach while attempting to lower this record.

The power plants for the monster juggernaut now being built in Los Angeles are probably the most powerful unit of gasoline motors ever built. One of these motors on a dynamometer test developed 1302 horsepower at 2600 revolutions per minute.

The motors are "Triplet-eights," similar in design to the "Twin-eight" used in a well-known automobile, with an additional bank of eight cylinders mounted vertically along the center line of the crank-case—24 cylinders in all. The bore of the cylinders is 5" and the stroke 6½", giving a total displacement in each motor of 3755 cubic inches.

Twelve carburetors supply the gas mixture—a carburetor for each two cylinders. Each cylinder has dual ignition; six distributors, twelve high-tension coils, and 48 spark plugs are utilized in the ignition of each motor.



Here is a front overhead view of the "Miss Los Angeles" as it will appear when completed. A telescopic sight will be placed between the front exhaust pipes so that the car may be "aimed."

The valve action is operated by an overhead cam-shaft similar to the war-time Liberty motors—in fact, these motors are built up with "Liberty" cylinders. To overcome torque in the long cam-shafts, they are gear-driven from both ends.

Each cylinder is fitted with an individual exhaust pipe. The accompanying photograph shows the exhaust pipes fitted to only one bank of cylinders.

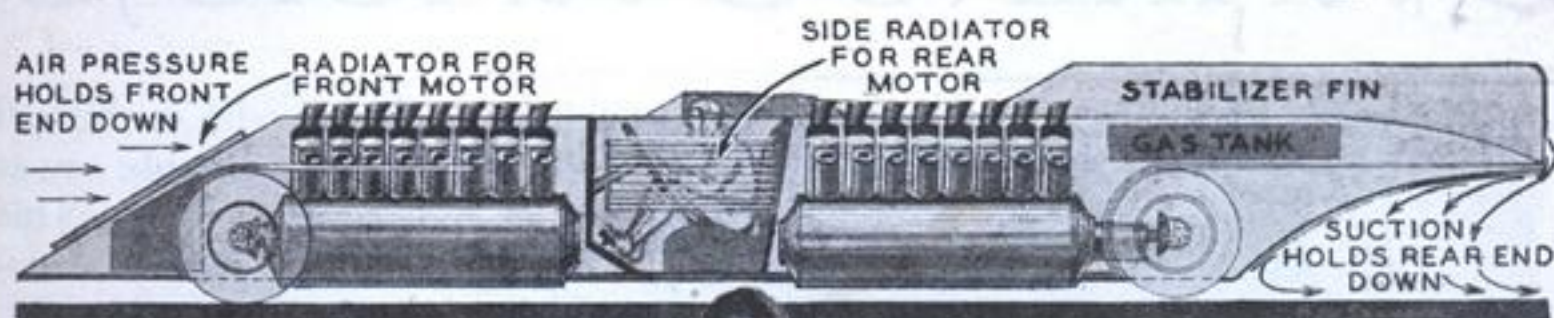
With 1300 horsepower delivered at one end of the crank-shaft, it is obvious that the shaft must be of massive design. The diameter of the main bearings is 3¾", and the shaft weighs 400 pounds.

The radiating surface of the cylinder walls is many thousands of square inches, so a huge volume of water must be circulated through the cooling system. The water pumps circulate 250 gallons a minute.

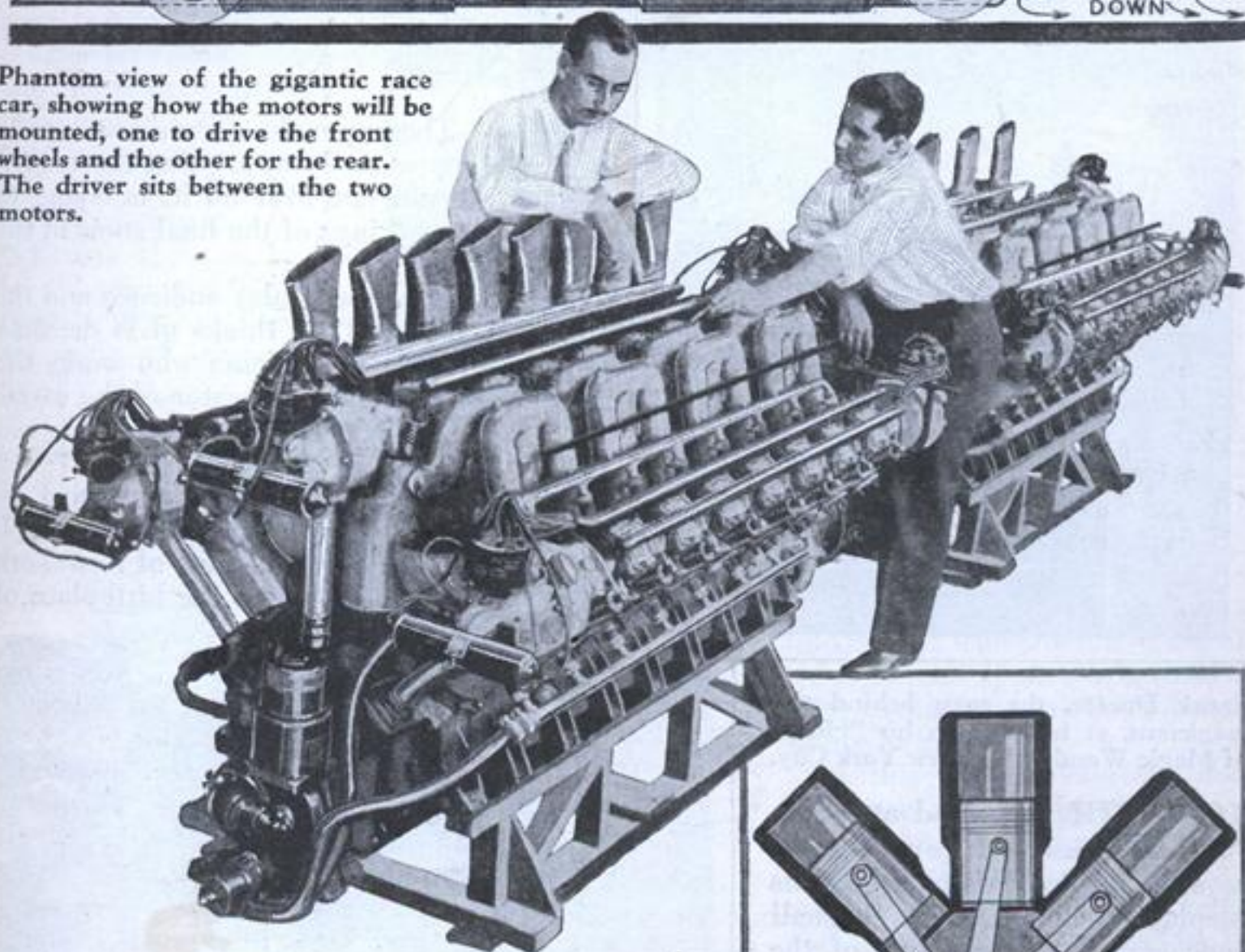
These huge motors are to be mounted in the chassis frame now being built, as shown in the sketch. One motor drives the front pair of wheels and the other the rear pair, with the driver's compartment between them. The forward motor is directly connected to the front wheels without clutch or gear-box. A clutch and gear-case with three forward speeds and reverse are interposed between the rear motor and the wheels, the forward motor being switched on after the car is in motion.

The body design dif-

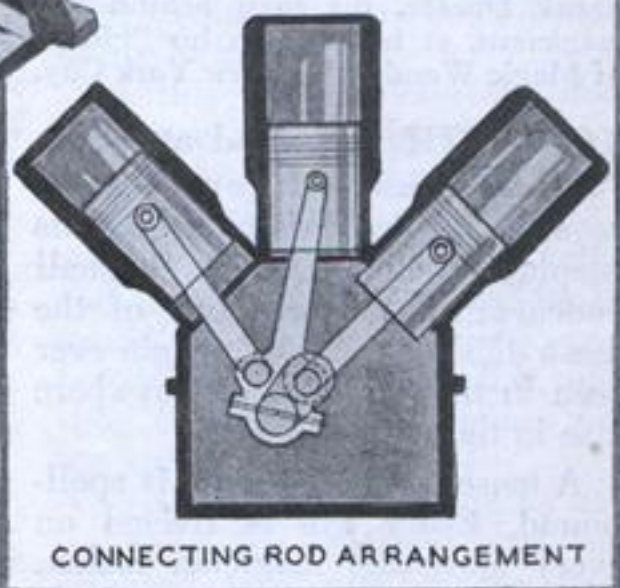
for 300 Miles an Hour Speed



Phantom view of the gigantic race car, showing how the motors will be mounted, one to drive the front wheels and the other for the rear. The driver sits between the two motors.



Here is a view of the two 24-cylinder motors which will drive the "Miss Los Angeles" at an estimated speed of 300 miles an hour. The exhaust pipes are not yet mounted on the side banks of cylinders. Each motor develops about 1300 horsepower, making them among the most powerful gas engines in the world. To the right is shown how the connecting rods are hooked to the crankshaft.



fers from many other speed juggernauts in that it is not radically streamlined. Rather than seeking to reduce wind pressure to a minimum the air pressure is used to push and suck the car to the ground and provide more positive traction.

The front of the car looks like a snow-shovel tractor, the force of the air against the inclined front pushing the front end of the car down. The under side of the rear of the body is dished out, and a powerful suction is created to hold the rear end of the car down.

The gear ratio between the motors and the wheels is 1 to $1\frac{1}{4}$; in other words, the wheels turn a quarter faster than the crankshaft of the motor. At 2600 r.p.m. engine speed the wheels will turn 3250 r.p.m. Fitted with 36-inch tires, this represents a circumference velocity of 514 feet a second—350 miles an hour. In actual practice, however, the theoretical figures are cut down due to slippage. Nevertheless, the builders are confident of smashing Major Segrave's record by a wide margin—maybe 300 miles an hour.

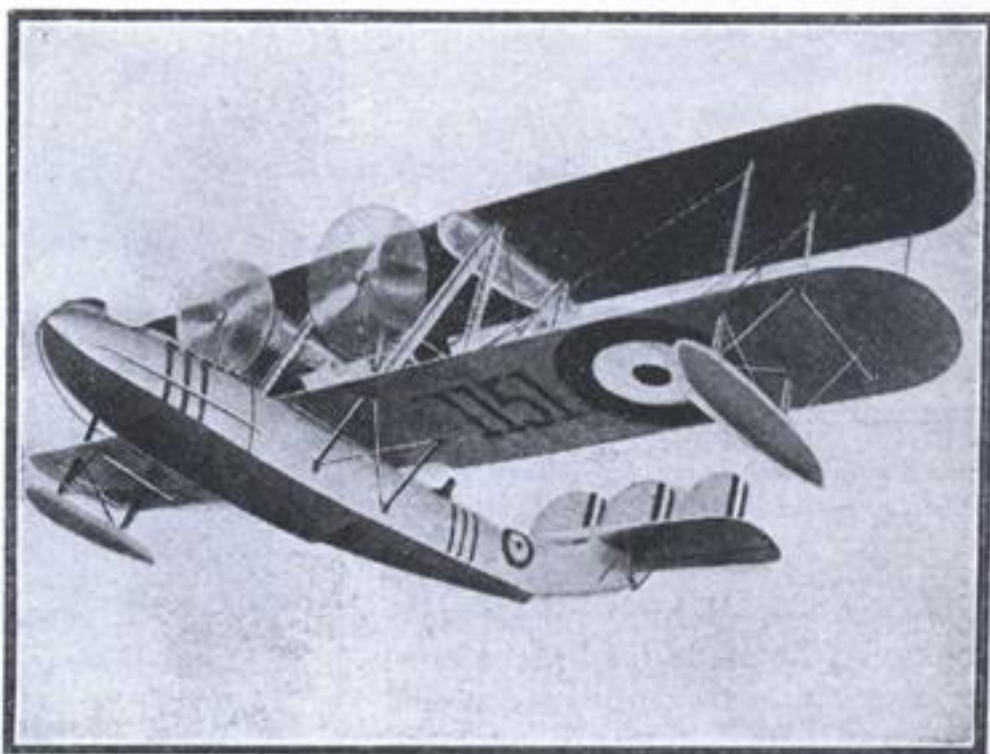
PLANE TALK

Edited by

MAJOR H. H. ARNOLD

Former Assistant Chief,
U. S. Air Corps

With a background as old as aviation itself, Major Arnold, who conducts this department, is well qualified to look into the future and speculate on probable methods of air transportation.



What Will Come Next—Air Trailers or Mammoth Planes?

A FEW years ago it was quite common to hear the expression, "It's a queer looking contraption but I don't think that it will fly." Today it is not a question as to whether or not it will fly for it seems as if any kind of device will fly as long as it has wings to hold it in the air and an engine to pull it or push it.

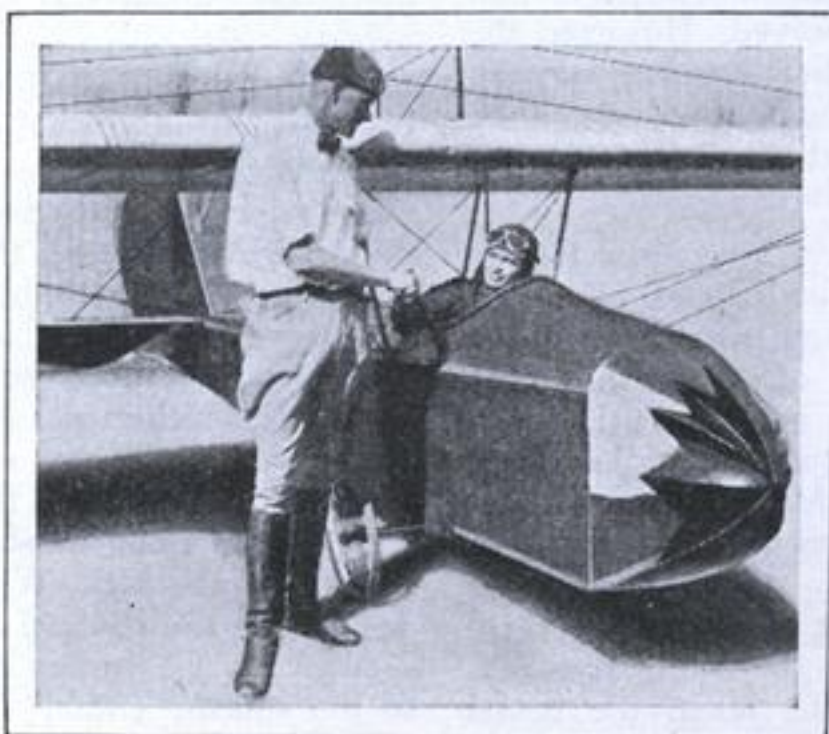
The airplane has been developed to such a point that it has now taken its place as a common carrier. Everyone expects it to be used as such and accordingly now accept, as a matter of course, feats which a few years ago would have been considered as utterly impossible. However there is a limit to all things. What is the ultimate in commercial aerial transportation?

If we go back a few years we find that there was a tendency among

designers and engineers to produce large multi-motor planes for commercial operations. They were slow but could carry a big pay load. The thought prevailed that even though the planes made but 70 to 90 miles an hour the destination was reached much sooner than it would be were any other form of transportation used.

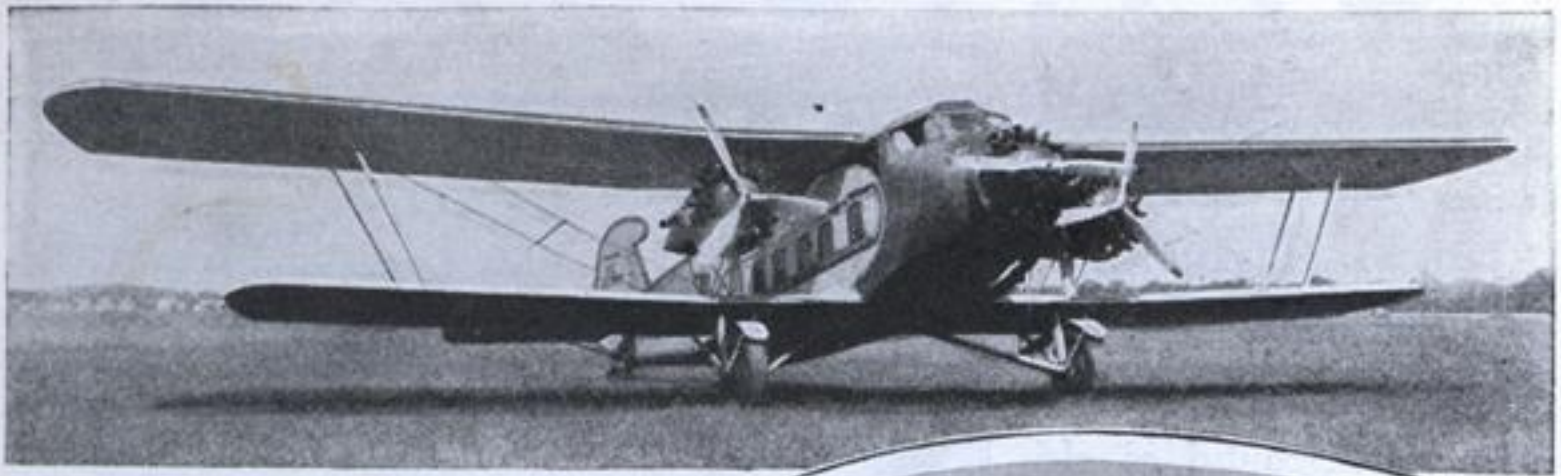
The American public demands speed. It makes no difference what use is made of the time saved, transportation must have speed or it will not be popular.

However, speed itself will not solve the aerial transportation problem. Hawks' itinerary for his flight across the continent would have satisfied patrons whose destinations were Wichita, Indianapolis and New York where he made his stops but how about those who wished to go to such points as Chi-



The first air-train about to start. The glider shown above, towed by a Waco, flew 160 miles in three hours.

Giant Transport Planes May Soon Be Locomotives of Great Air Trains

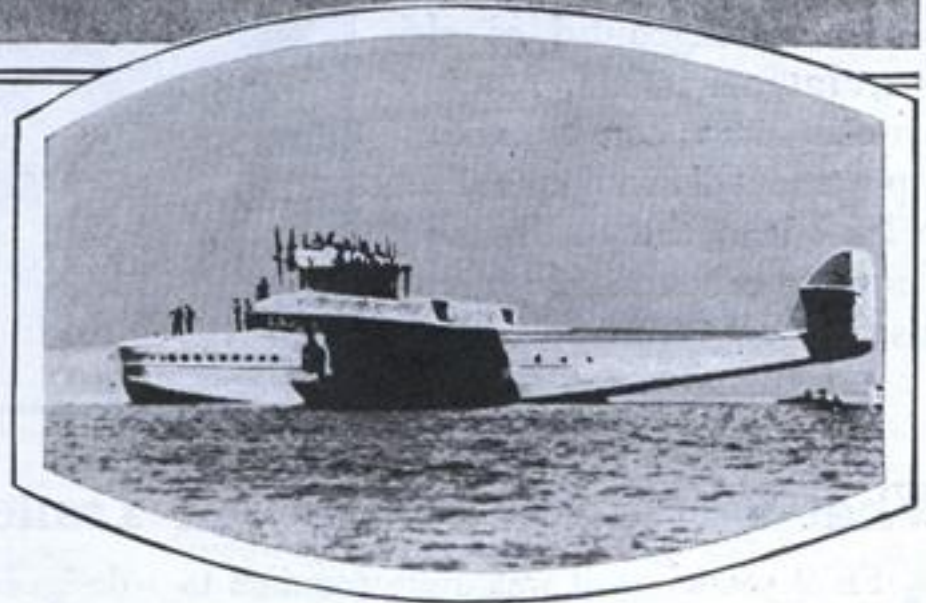


America's answer to the mammoth plane problem — the Boeing Air Transport.

cago, St. Louis or Kansas City? Obviously on all long lines provisions must be made for branch connections and intermediate stops. However, if such stops are made the time en route is greatly increased and the demand for speed not satisfied.

What manner of aircraft then can be used to the variety of demands imposed? The through traffic requires maximum speed with a minimum number of intermediate stops. However, there probably will be as much income from the intermediate traffic, that with points of origin and destinations between the ends of the line. The first thought which comes to mind is a large number of air-liners each with a different destination. Certainly by this means all airports and branch lines could be served. However, the expense would be terrific. Another solution is to put into effect the idea advanced by Anthony Fokker several years ago—a towing plane with air trailers.

It has not been so very long since Hawks traveled across the United States in an air trailer. The elapsed time was rather long but the practicability of the trailer was demonstrated. Fokker advanced the idea that several trailers could be pulled by a single towing plane. As a matter of fact there are people working along that line at this time. Accordingly perhaps we will some day see a towing plane with several air trailers flying along the route from say, St. Louis to Cleveland. When the aerial train arrives over the airport at Indianapolis, a trailer will be uncoupled and brought to earth by its pilot. Similarly other trailers

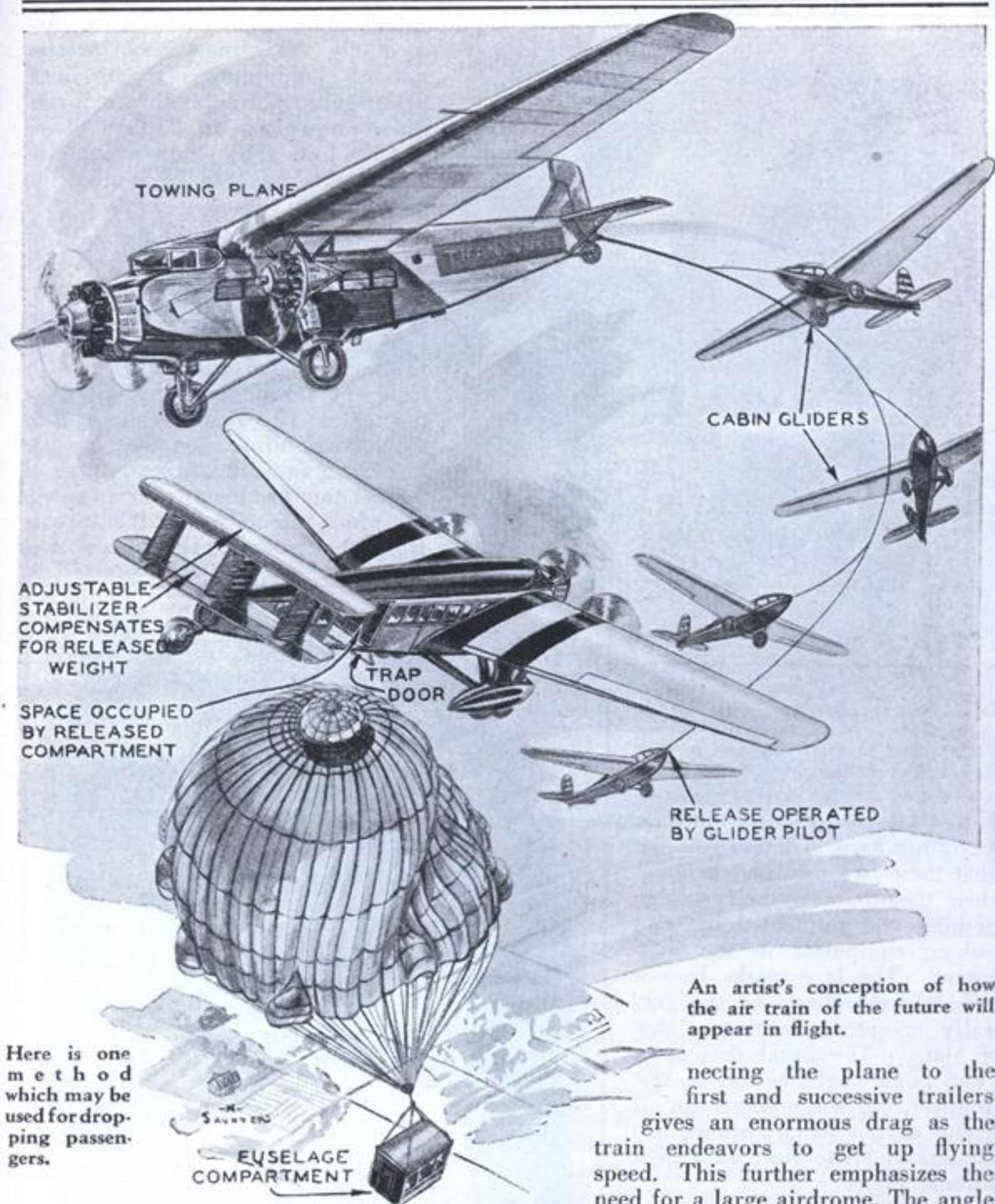


The world's largest plane, the Dornier X, powered with 12 Curtiss engines, has carried 160 persons on flights.

will deliver their cargoes to Dayton, Columbus and any other point en route where a pay load makes it worth while.

Another method of securing the same service would be to have large cargo planes with parachutes attached to light weight platforms. When the destination for cargo or passengers was reached, the steward, after loading up the platform, could pull the lever which would allow the parachute to deliver its load. The cabin of the large plane would have to be so constructed that these parachutes with their platforms could be set up during flight. Perhaps an additional cabin would solve the problem as all arrangements could be made without discomfort to other passengers or making a rearrangement of the cargo necessary. An opening in the floor the size of platform with a trap door to shut when not in use would fill the bill. When approaching the destination the steward might call out, "Passengers for Columbus please move forward to the shuttle 'chute." Then baggage, passengers and any express would be attached to the platform and the 'chute dropped. It sounds rather far fetched at this stage of

Two Likely Methods of Discharging Passengers at Intermediate Stations



Here is one method which may be used for dropping passengers.

aircraft development but passing years change many things.

It is quite easy to picture a towing plane with its trailers taking the air but things look different when plans are made for its accomplishment. The train must of necessity be rather long and thus requires a very large airdrome. The various cables con-

An artist's conception of how the air train of the future will appear in flight.

necting the plane to the first and successive trailers gives an enormous drag as the train endeavors to get up flying speed. This further emphasizes the need for a large airdrome. The angle which the trailers make with the line

of travel differs while running along the ground from that taken when traveling through the air. This could be taken care of by a system of bridles attaching the trailers to a main cable.

The problem becomes simpler when the train is in the air. The pilots of the trailers then have a steady pull to take care of.

10-mile Ascent Paves Way



The Piccard balloon being inflated. Observe that no suspension net is used, gondola ropes being attached to the skin.



Seen through the porthole of the 220-pound aluminum gondola in which they ascended 52,000 feet above the earth are Charles Kipfer, left, and Prof. Auguste Piccard. Oxygen tanks kept the pressure inside the sphere approximately the same as at earth level. Their flight lasted 16 hours.

Planes speeding through the thin air miles above the earth at speeds of 400 m.p.h.—power balloons floating 20 miles above the earth, deriving electric energy from outer space—these are some of the amazing possibilities pointed out by scientists who ascended 10 miles in a balloon.

A FEW days ago two Swiss balloonists, Prof. Auguste Piccard and his assistant Charles Kipfer, ascended more than 52,000 feet into the atmosphere in a hermetically-sealed metal gondola suspended from the largest balloon ever built. In the universal acclaim evoked by this amazing achievement, the startling scientific significance of the adventure has been somewhat obscured by the mere fact that a new altitude record was set. As far as the every-day life of the human race is concerned, altitude records are insignificant, but certain facts observed by the balloonists are likely to be of vital importance to every one of us.

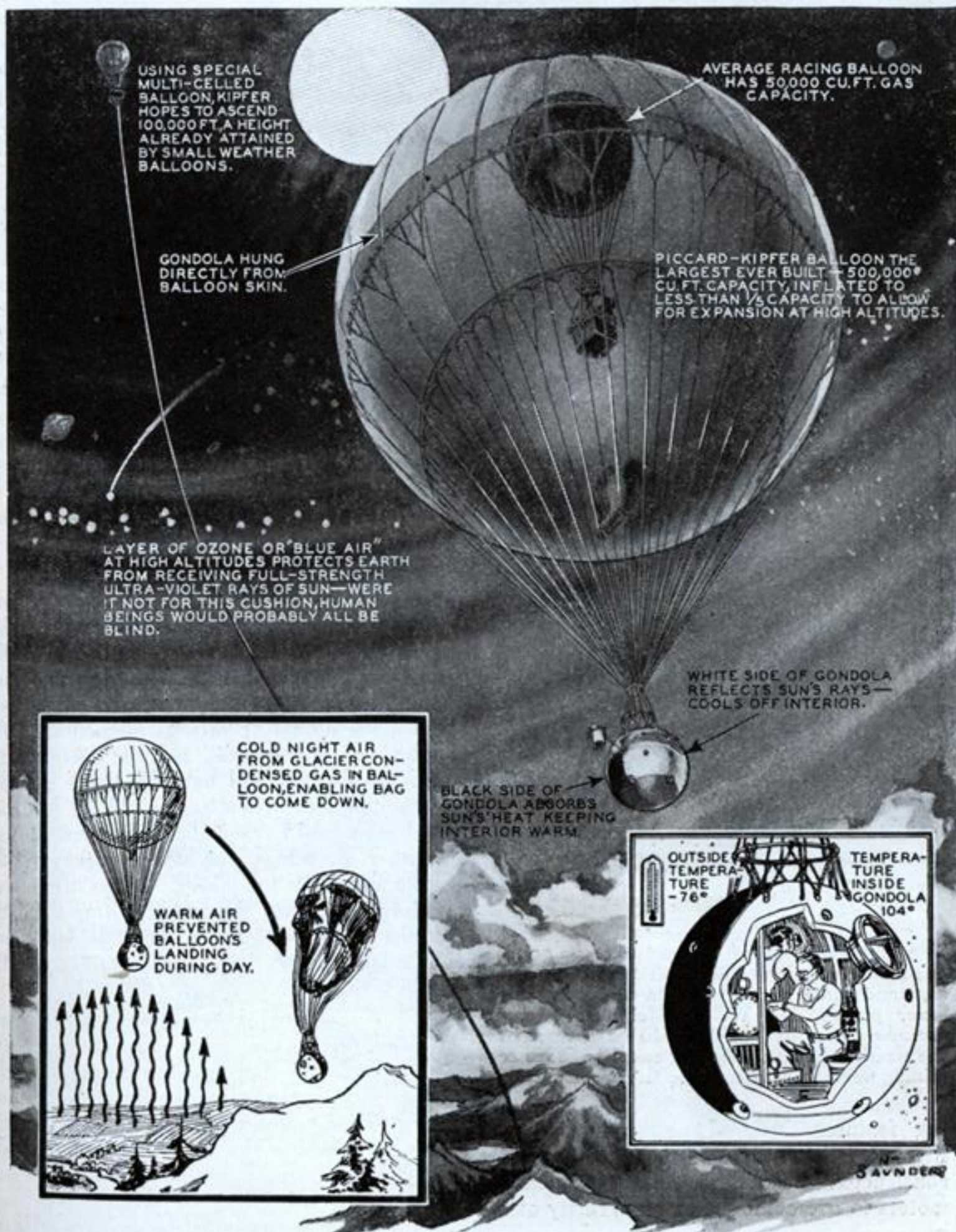
Two observations made by Piccard are of supreme importance. The first of these is that in the stratosphere—that region of rarefied air which begins approximately seven miles above the earth—airplanes will soon travel at speeds of 400 miles an hour, the passengers protected within air-tight cabins.

And the second observation, fantastic at first glance, but soundly scientific for all that, is that there is a tremendous source of thermal energy in the stratosphere which may some day be harnessed and made to furnish power to turn the wheels of the world.

Stratosphere planes—meaning airplanes capable of flying at ten-mile heights—are already being constructed. One ship is being built at the Junkers works in Dessau, Germany, and is practically ready for tests. Another is under construction in France, and is of wood and metal, without glass. The Junkers ship has specially made glass to withstand altitude pressures. Details are kept strictly secret.

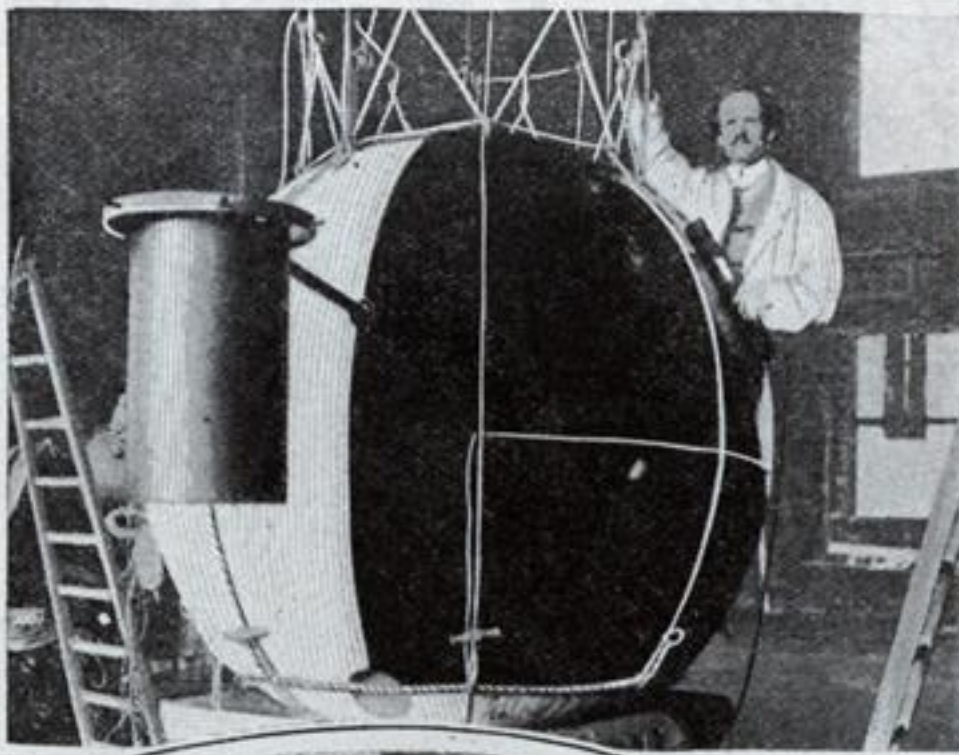
Prof. Piccard made his ascent in an air-tight aluminum ball, and thereby proved that man can live in the stratosphere when so protected. A stratosphere plane, combin-

for Stratosphere PLANES



Important facts of the Piccard-Kipfer balloon ascent are pictured above. The balloon landed on a glacier at Ober Gurgl, Austria, where the cold air contracted the gas in the bag sufficiently to permit it to descend, after it had drifted for 16 hours, unable to come down because the heat rising from the earth increased the lifting power of the gas. Their balloon was 100 feet in diameter. It could not be fully inflated at the start because the expansion of the gas at high altitudes would have split the fabric. They ascended nearly two miles higher than man has ever gone before.

Piccard Balloon Gondola Half Black, Half White to Regulate the Heat



Top photo shows Prof. Piccard with the gondola of his balloon, painted black on one side to absorb heat and white on the other to reflect it. In the lower picture, Dr. W. M. Meisinger is shown ascending in a balloon to make observations for the weather bureau, carrying small balloons containing weather instruments to release at high levels.

ing features declared necessary by Prof. Piccard, is illustrated on page 63. Specially constructed propellers and supercharged motors to overcome the extreme rarity of the upper air, and sealed cabins within which oxygen is generated for the passengers, are absolute essentials of such a plane.

One difficulty which has always troubled designers is that a stratosphere plane would require a large wing spread and great power

to keep it aloft at high altitudes. At lower levels huge wing spreads are impractical because of the resistance of the denser air. To overcome this, a telescoping wing has been suggested which can be extended to a large area in the stratosphere and retracted when traveling near the ground.

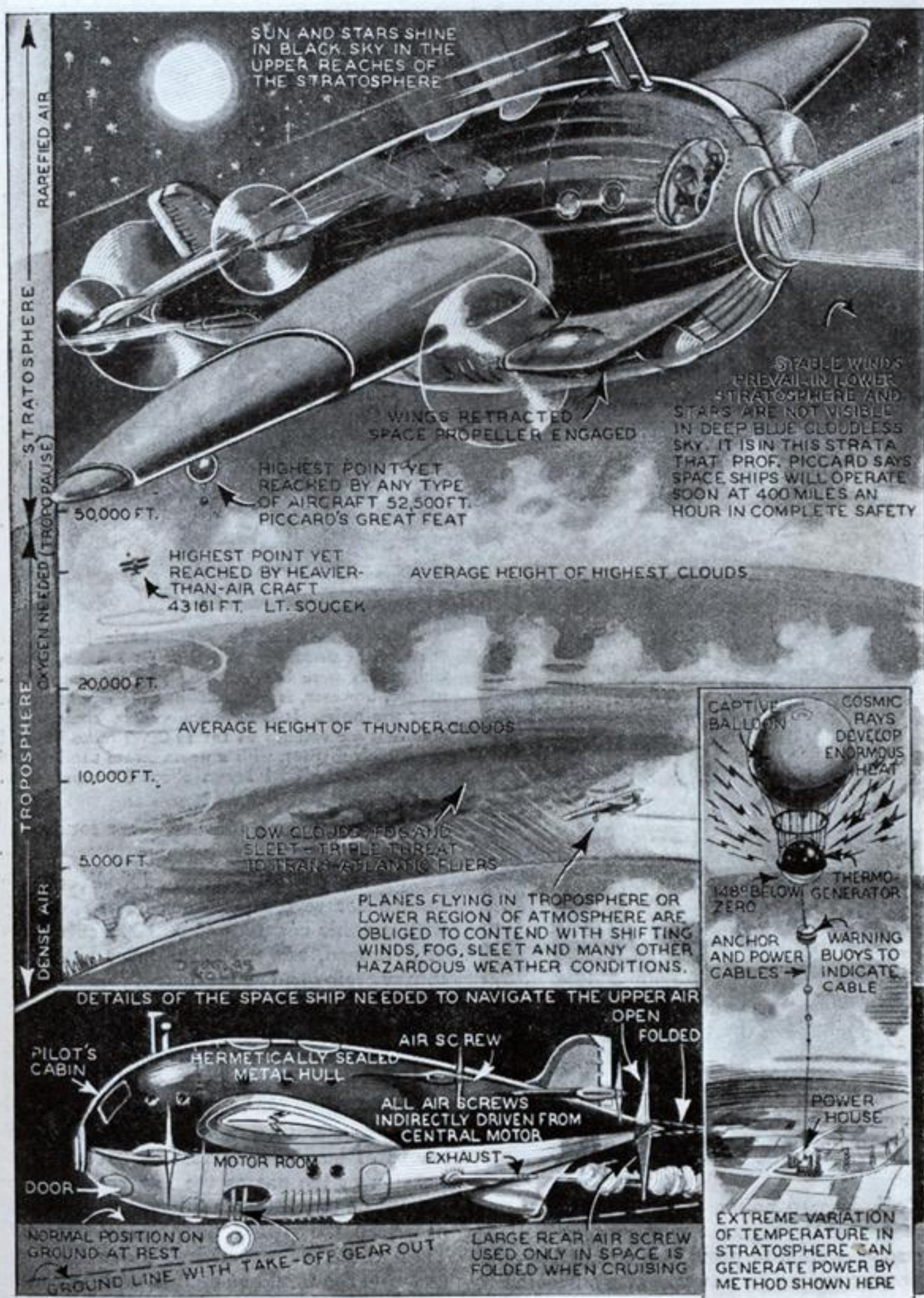
High-speed winds of constant velocity are counted on to speed the stratosphere plane. It has always been thought that a wind constantly blowing to the east exists at high levels, created by the earth's rotation, but Piccard's observations indicate that there are different strata of wind at various altitudes and that directions vary. The pilot of the stratosphere airplane will probably be able to climb to levels where he can select the winds which will speed him along his course.

One of Prof. Piccard's objects was to measure cosmic radiation. Nobody knows exactly what cosmic rays are, nor where they spring from, but it is generally believed that they reach the earth from outer space and that they provide the power which breaks down the atoms of various elements on the earth. If that is true, and the cosmic rays can be trapped and harnessed, the age-old dream of the alchemists would be attained and man could transmute one element into another, or release the stored energy in the atom and use it for power. It has often been pointed out that the energy stored in the atoms of a cup of water would be sufficient, if released, to drive a liner across the Atlantic.

Prof. Piccard claims definitely to have proved that cosmic rays emanate from the stars, and that they are far more powerful in the stratosphere than on the earth. Inside the Piccard balloon gondola the temperature was, at one time during the ascent, 104 degrees above zero Fahrenheit, while the outside temperature was 76 below. The heat developed was attributed to the rays striking the gondola, and the tremendous extremes in temperature offer a source of power which may some day be harnessed for man's uses.

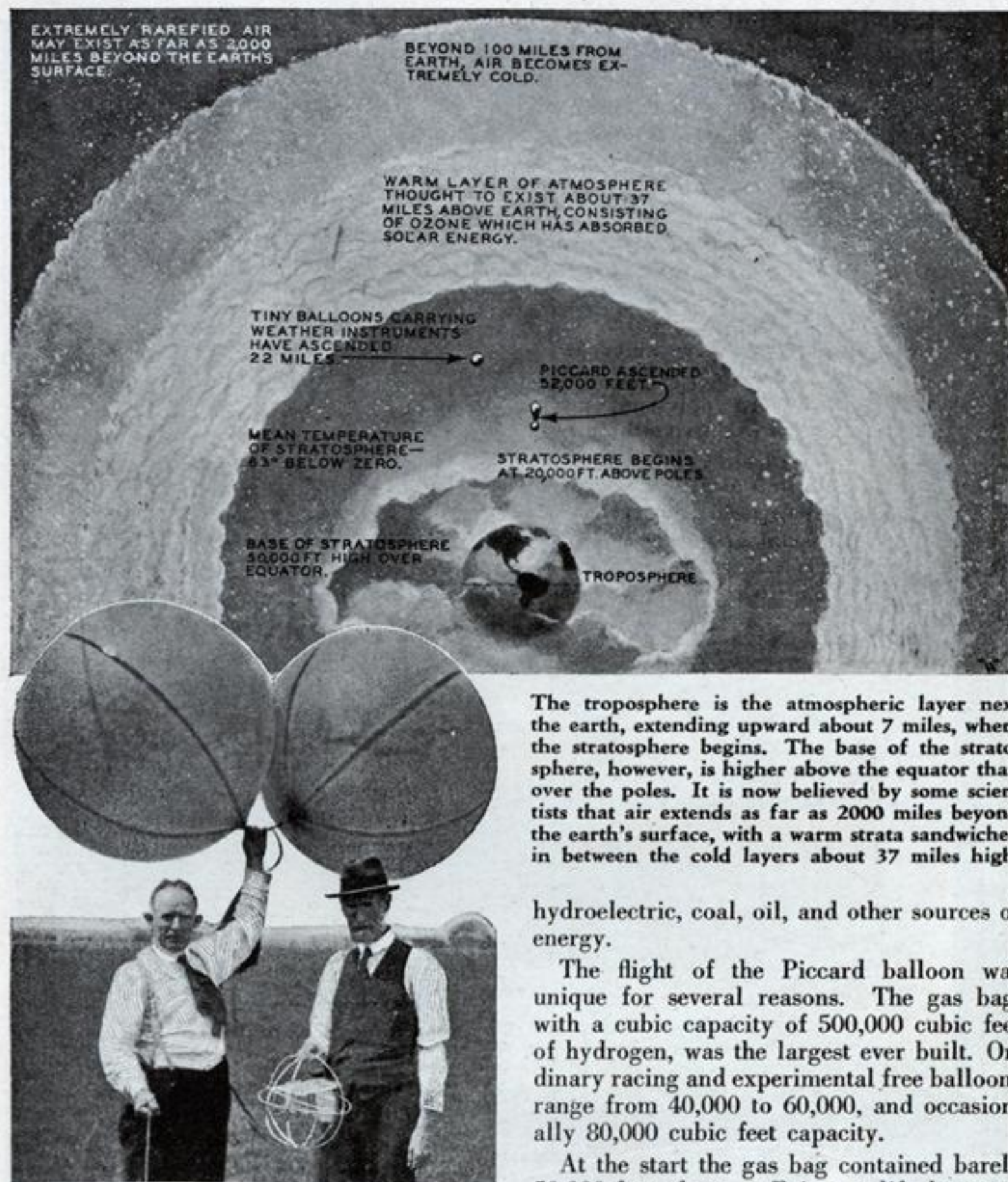
Although at a 50,000 feet height the rays are not powerful enough to harness for use,

Stratosphere Cabin Must Be Air Tight; Telescope Wings May Be Used



Details of a stratosphere plane, embodying features essential to high-altitude flying, are shown in this drawing. The insert at the right gives an artist's conception of Prof. Piccard's suggested method of deriving power from cosmic rays whose effects he measured approximately ten miles above the earth.

Atmosphere Divided Into Several Strata; Air May Be 2000 Miles Thick



Sounding balloons which these meteorologists are holding have ascended 22 miles into the atmosphere carrying various recording instruments.

Prof. Piccard points out the possibility that at a slightly higher elevation they will be strong enough to provide a new and revolutionary source of power. If man learns to harness this heat and convert it into electricity, the upper atmosphere of the world a century or so hence may be dotted with floating power balloons which will supplant

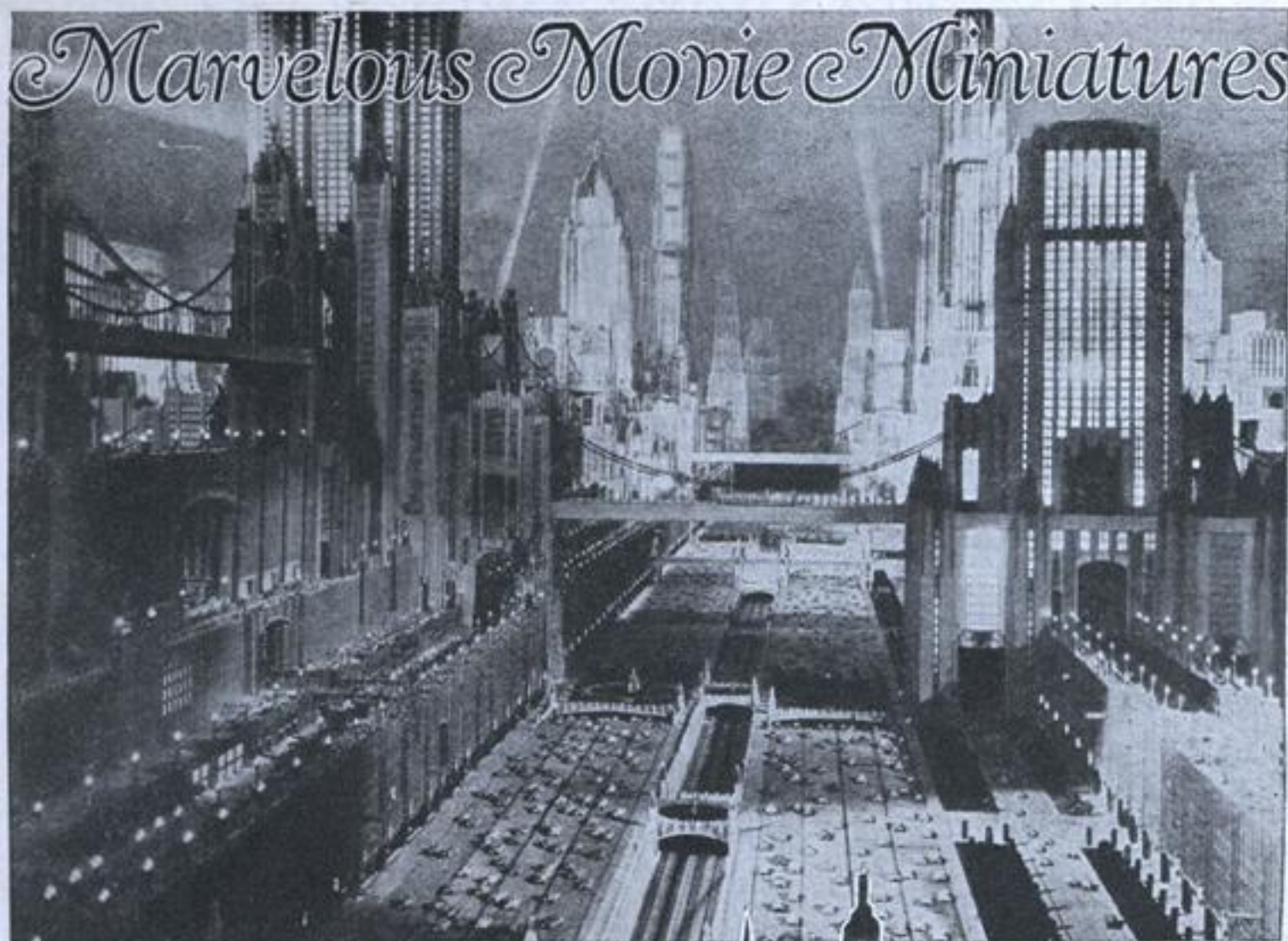
The troposphere is the atmospheric layer next the earth, extending upward about 7 miles, where the stratosphere begins. The base of the stratosphere, however, is higher above the equator than over the poles. It is now believed by some scientists that air extends as far as 2000 miles beyond the earth's surface, with a warm strata sandwiched in between the cold layers about 37 miles high.

hydroelectric, coal, oil, and other sources of energy.

The flight of the Piccard balloon was unique for several reasons. The gas bag, with a cubic capacity of 500,000 cubic feet of hydrogen, was the largest ever built. Ordinary racing and experimental free balloons range from 40,000 to 60,000, and occasionally 80,000 cubic feet capacity.

At the start the gas bag contained barely 50,000 feet of gas, sufficient to lift the metal ball containing the two aeronauts with their instruments and equipment and the 500 kilograms of lead shot carried as ballast. Expansion of the gas as the bag rose was depended on to gradually fill out the giant bag and keep the lifting force fairly constant. The balloonists' experience shows how unbearable life would be on this earth if it were not for the insulating layer of air, which absorbs and blocks off much of the sun's heat by day, and prevents escape of much of the earth's heat by night.

Marvelous Movie Miniatures

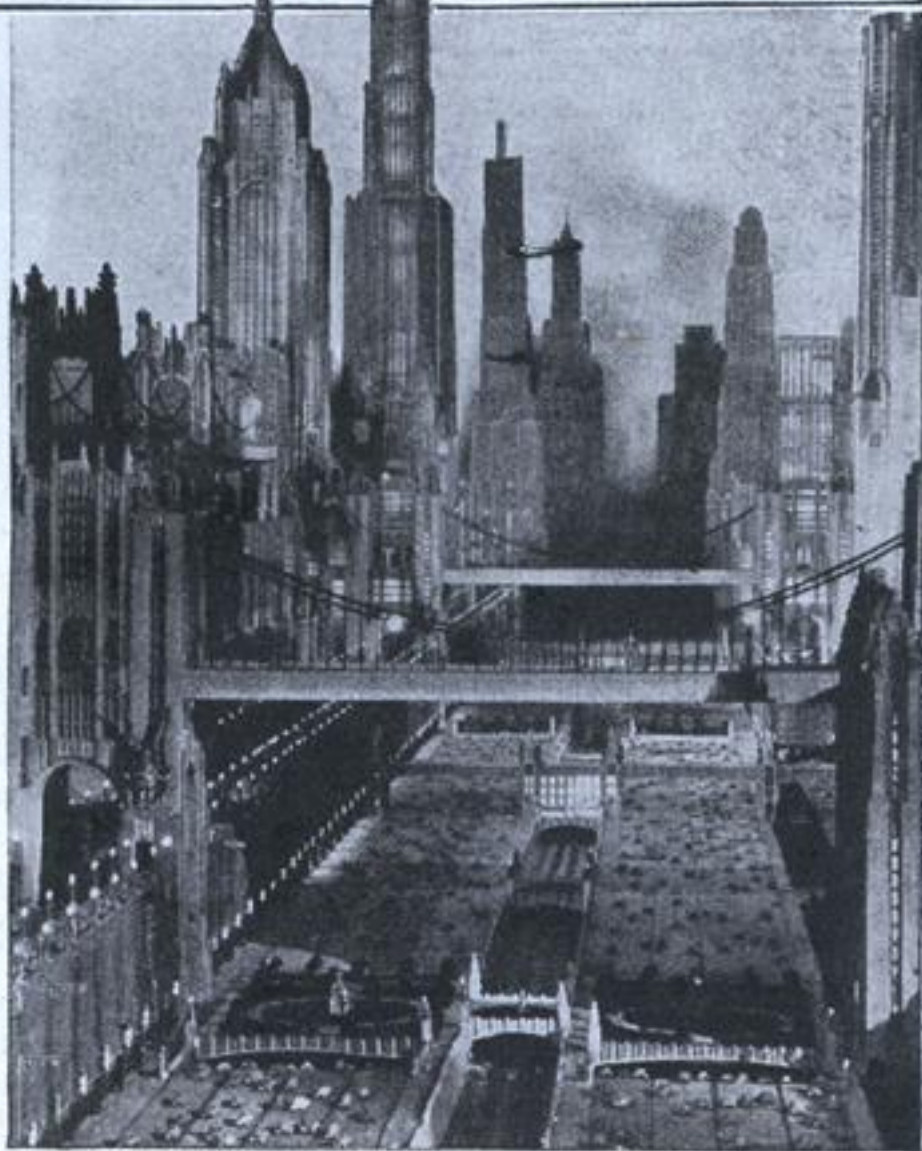


Nine lanes of traffic, all moving on belts, are shown on the ground level.

THE scenarist's dream of New York City in 1980 has been done in miniature at Hollywood for "Just Imagine," a motion picture fantasy. This model took five months to complete and cost approximately \$200,000. It was built in an old blimp hangar once used by the U. S. Army balloon corps and covers a ground area 75x225 feet, representing the most extravagant effort yet conceived by the American cinema industry.

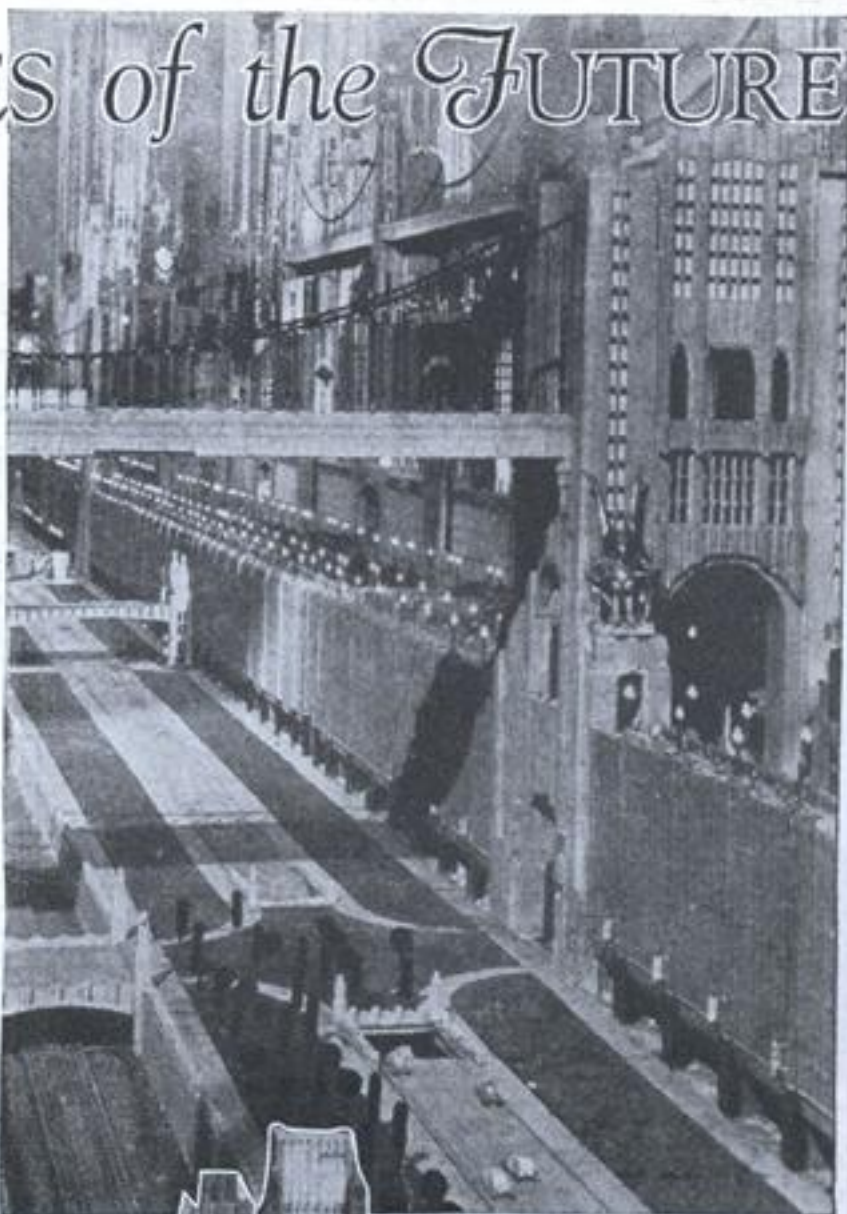
Lofty office buildings 250 stories high, canals carried overhead on suspension cables, airplanes that land on a few square feet of flat space on the side of tall structures, streets with nine lanes and nine levels of traffic, are among the interesting features. Although the model city is futuristic, its construction violates no engineering practices. It is really engineering skill carried a bit farther than today.

A crew of 200 technical experts and artisans moulded and built the miniature, which is raised on a plat-



The city of the future should be a pedestrian's paradise with foot bridges crossing the traffic at each corner.

Portray CITIES of the FUTURE



The architecture is ultra modern, but not so much unlike our present American cities. Note subway at lower left.

form above the ground. More than five tons of plaster, to say nothing of hundreds of pounds of lumber, glass and other materials, were employed in this "giant" miniature, the tallest tower of which is 40 feet high — which would be close to 2000 feet in actuality. The model is built to a scale of one-fourth inch to one foot.

The utmost fidelity to truth was observed in making this set. No details of exterior construction were left undone. Even real glass was used for windows, and the plaster was colored just the same as in real structures.



Night in the miniature city. Note helicopter aprons on the tower.

WORLD'S LARGEST STATUE



Gutzon Borglum, famous sculptor-engineer, is here seen directing his associates at work on the colossal Washington figure of the Rushmore Memorial. Workmen engaged in carving are suspended on figure by safety harness attached to steel cable.



Three titanic figures of the Rushmore memorial come in view of motorists as they emerge from the last tunnel on the new Iron Mountain Highway in the beautiful Black Hills of South Dakota.

THE world regards with awe the stupendous sculptural achievements of the ancient engineers who built the Egyptian Sphinx, the Colossus of Rhodes and the Pyramids, but now it has a new monumental edifice to marvel at which dwarfs the projects of the ancients to almost insignificant proportions.

In the Black Hills of South Dakota a group of engineers, captained by the famous sculptor-engineer, Gutzon Borglum, are carving from a mountain of living granite the figures of Washington, Jefferson and Lincoln, whose faces alone measure sixty feet from chin to cranium top—twice the height of the face of the Sphinx of Gizeh.

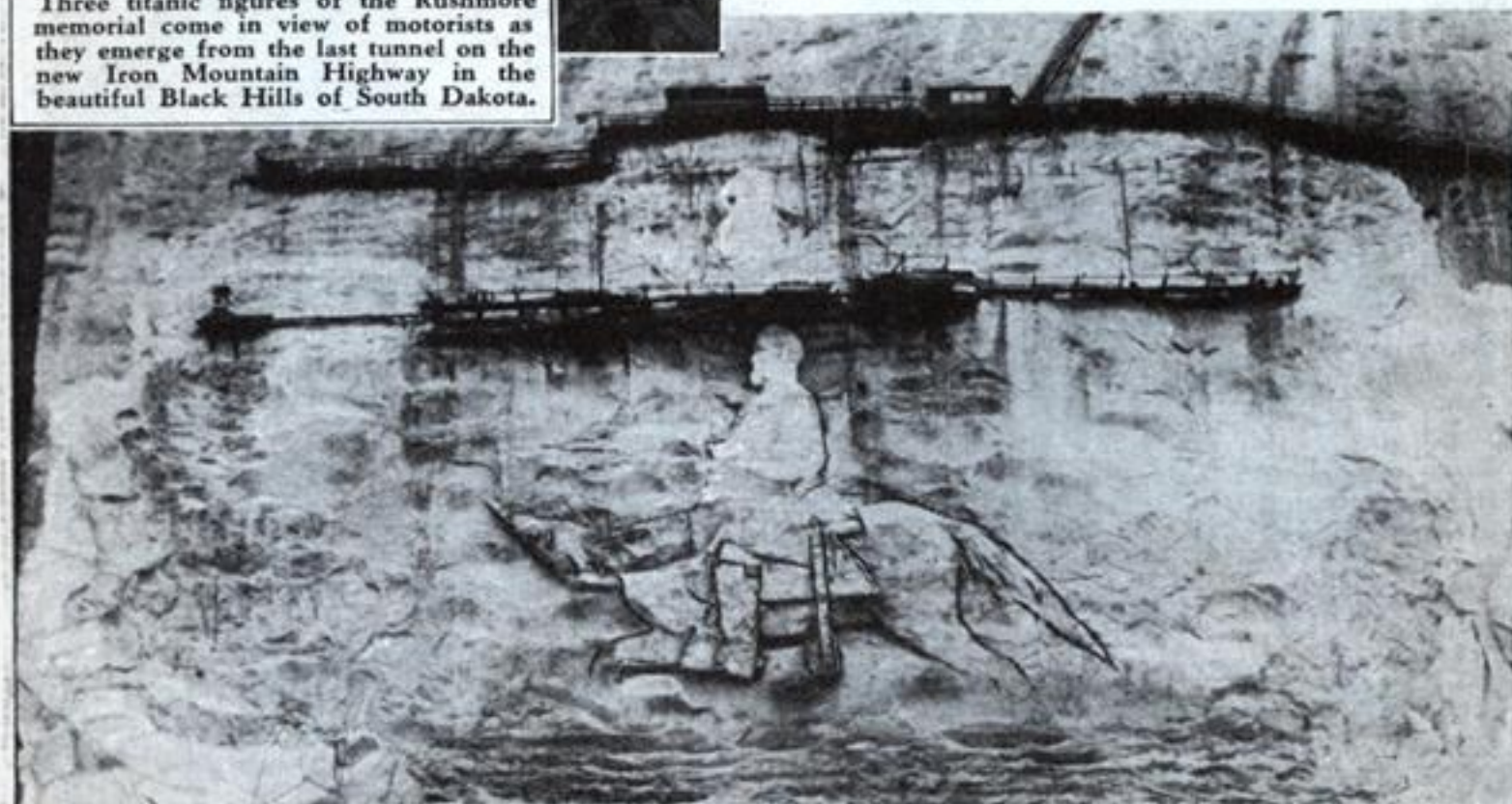
Borglum Explains Engineering Procedure

In a special interview with a MODERN MECHANIX correspondent, Mr. Borglum explained the engineering procedure by which he is attacking his titanic job.

"First," the bronzed and rugged sculptor said, "I prepared a small scale model to get the proper grouping of the three figures. This work was done in a studio with a great plate glass window looking out upon Rushmore.

"Next I made a working model of Washington which was five feet from the chin to the top of his head. This model was taken to the top of Rushmore and used to guide the carving of the great stone head.

"The measurements taken from the working models are multiplied by twelve—an inch on the model being a foot on the statue—and are transferred to the granite



Designed by Borglum, this gigantic figure of General Robert E. Lee carved in bas relief on the living granite of Stone Mountain, Georgia, is another sculptural engineering project which bids fair to endure through centuries and centuries like the Sphinx and the Pyramids. The job, retarded by political dissension, has proceeded to stage shown here. The mounted figure of General Lee was sketched from huge image projected on mountainside by means of a powerful magic lantern.

CARVED IN MOUNTAIN

of Mount Rushmore with the aid of a 30 ft. swinging boom and plumb bob.

"This boom swings horizontally through a graduated arc of 180 degrees. The plumb bob may be suspended from any point upon it. After setting the angle, the distances horizontally outward and vertically downward to the rock are measured by tape. Skillful engineering here is as important to the work as artistic modeling.

"When the work was first begun, I picked the largest sound piece of granite for the figure of Washington," Mr. Borglum continued. "The carving of the rock monument consisted in excavating the excess granite by a process of drilling and blasting which removes successive thin layers without injuring the mountain itself. As little as ten inches of granite can be moved at one time.

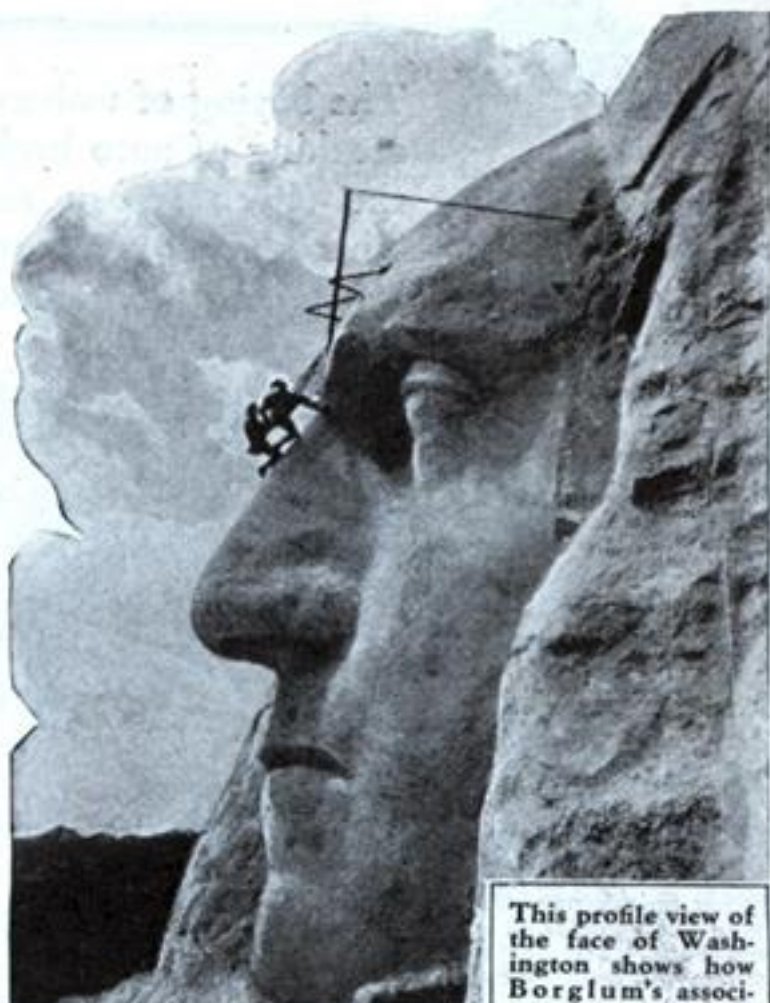
Engineers Work in Safety Harness

"This process proceeds to within a few inches of the final surface, and then the finishing is done by a 'broaching' process.

"There are no reserved seats at Rushmore. Workmen when engaged in actual carving are suspended over the edge of the cliff in steel and leather harnesses attached to a $\frac{3}{8}$ inch steel cable. These cables are 'paid out' or reeled in by hand winches.

"Usually ten Ingersoll-Rand 'R12 Jackhammer' drills are on the job for the rougher work. When in use these, too, are attached to cables. The drills are $\frac{7}{8}$ inch steel finished with cross bits.

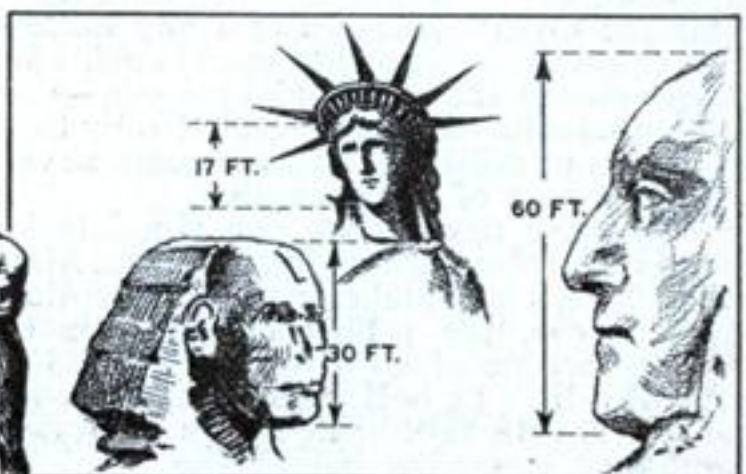
(Continued on page 140)



This profile view of the face of Washington shows how Borglum's associates hang suspended in safety harnesses when boring holes for blasting or "broaching" to produce a fine finished surface.

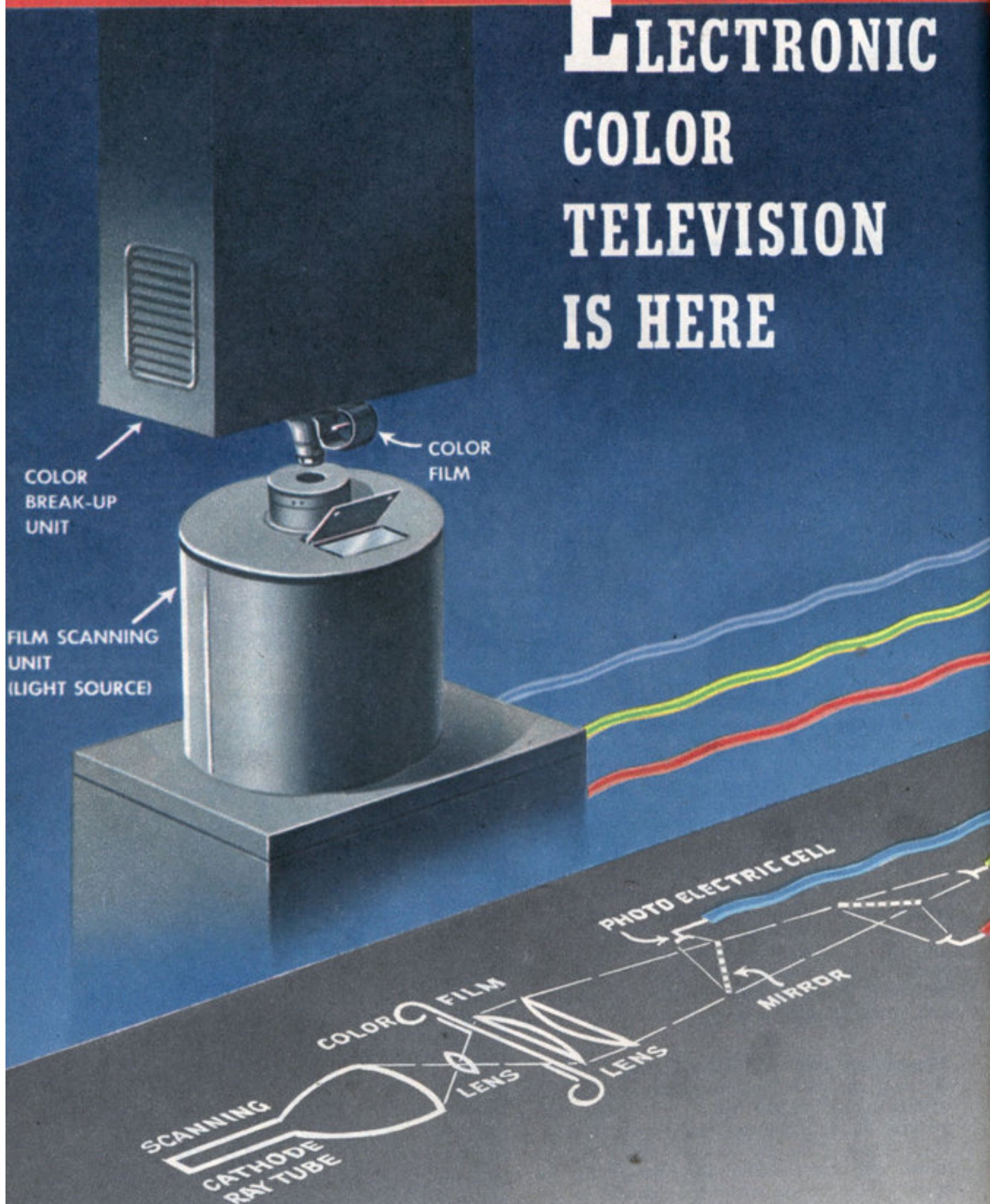


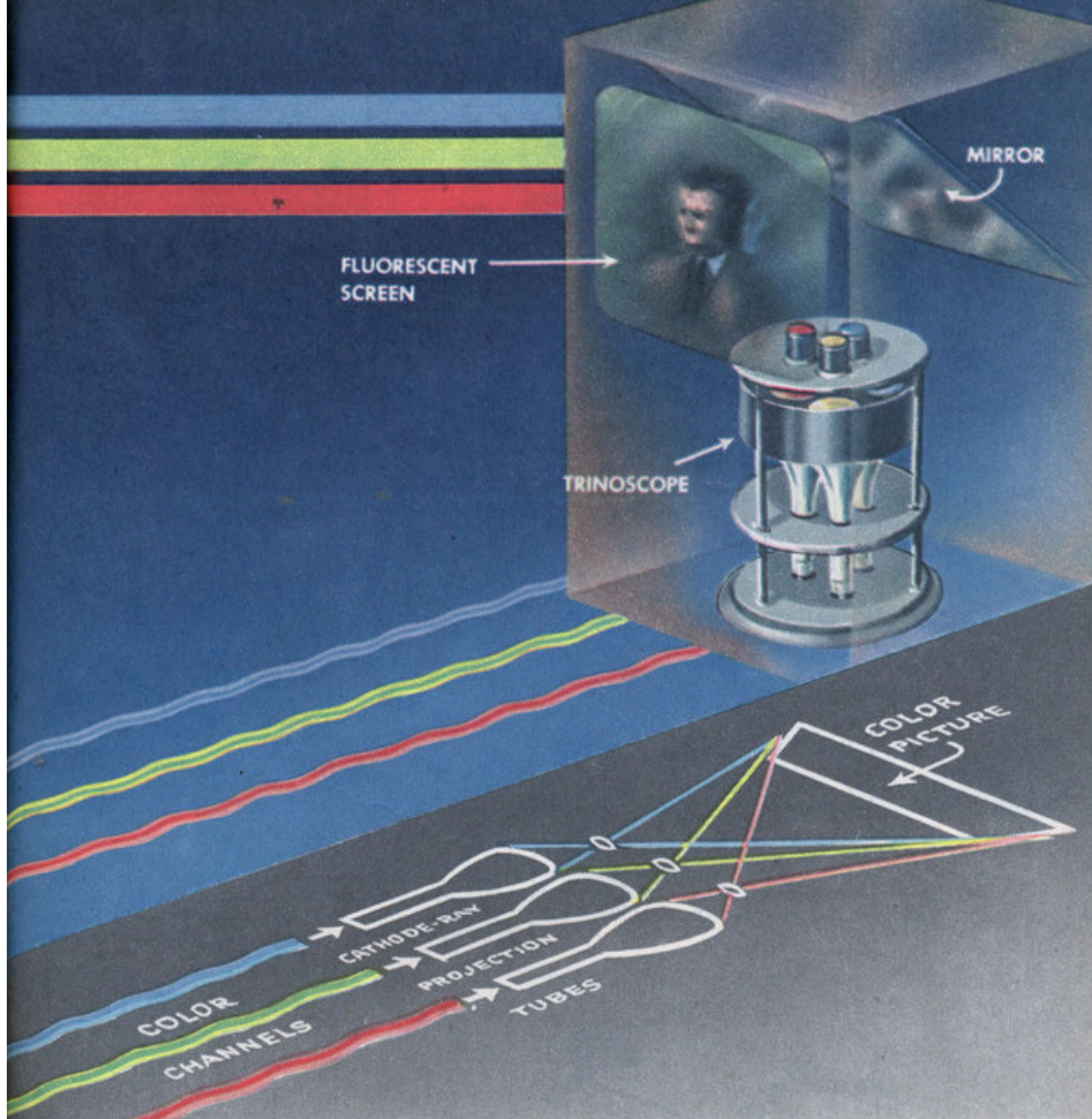
Workers drilling holes for dynamite sticks which blast away the stone to shape facial features. Charges in 67 to 75 holes are set off simultaneously by 110-volt current.



How Rushmore faces compare with Sphinx of Gizeh and Statue of Liberty. Left—drawing illustrates manner of transferring measurements from 5 ft. model to huge mountainside figure.

ELECTRONIC COLOR TELEVISION IS HERE





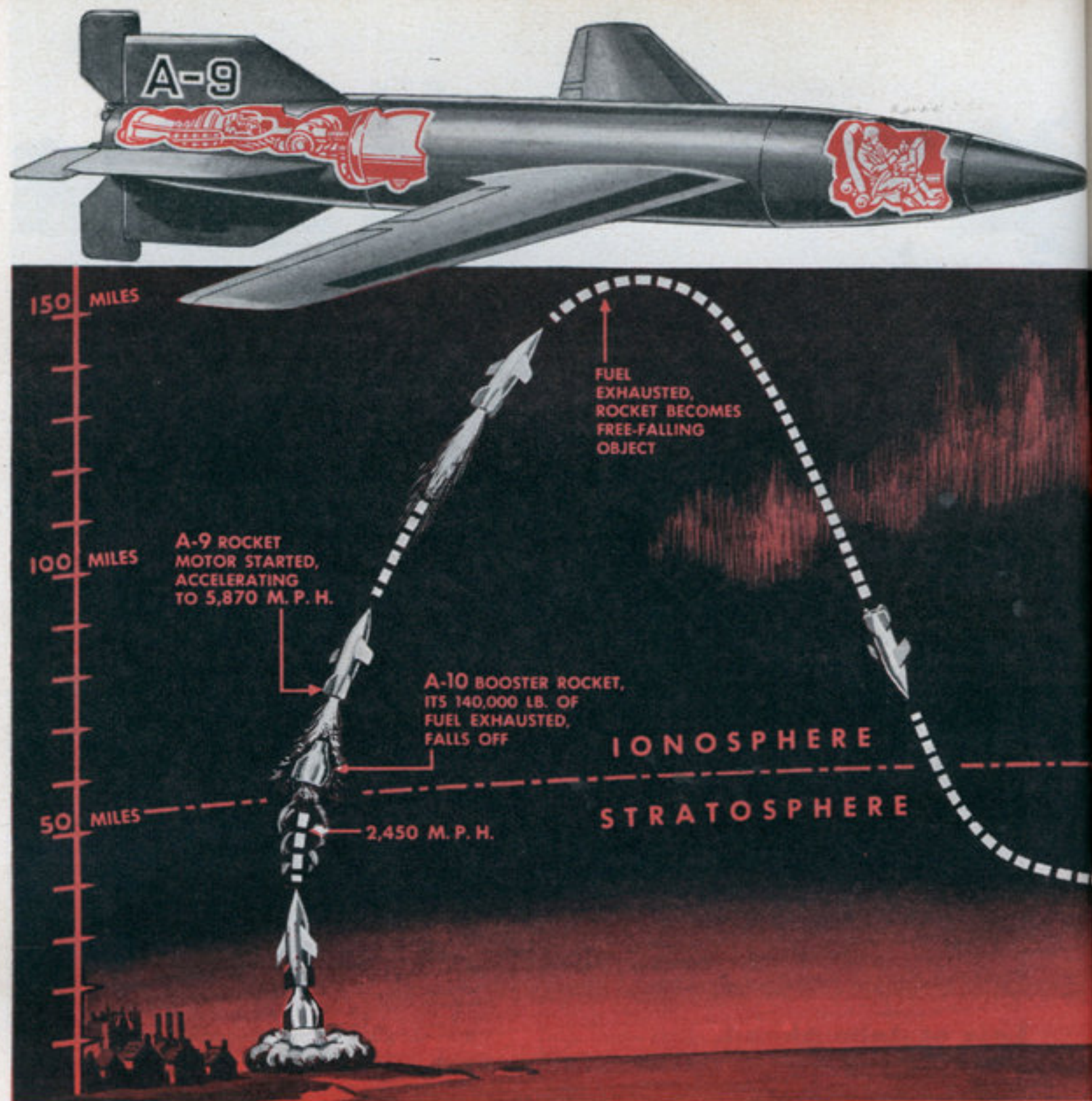
ALL-ELECTRONIC color television, which RCA engineers have achieved in a form that does not make black-and-white equipment obsolete, is a complete departure from the mechanical color transmissions of recent years. Mirrors and photoelectric cells replace moving parts.

In a recent demonstration at Princeton, N. J., pictures were broadcast with a new color-slide camera. Its developers plan laboratory transmission of live-action studio scenes by mid-1947, outdoor action scenes late in 1947, theater-size pictures in 1948.

The electronic system's mirrors and tubes split a beam of light into red, blue, and green images. Three kinescopes in the receiver pick up the separate images simul-

taneously—in contrast to mechanical systems in which a rotating filter transmits the three colors one at a time—and project a merged, flickerless picture.

Color television requires much higher frequencies than black-and-white work because a wider band must be used. The operating standards, however, such as the scanning rate, number of lines, and rate of picture repetition (30 per second), are the same as in commercial television. So a frequency converter would suffice to equip any black-and-white receiver to handle color broadcasts in black and white. Thus the advent of commercial color television—still some years away by RCA estimates—need not make present sets obsolete.



Target New York: Two-stage supersonic rocket was goal of Nazis' A series of secret weapons.

Transatlantic Roller Coaster

WHEN the Allied invasion upset the Nazis' plans, they had a supersonic, 3,000-mile-range rocket in the works. Already in the blueprint stage was its successor—a true rocket bomber of equal speed and range. Actual sketches and plans for it are shown on page 110.

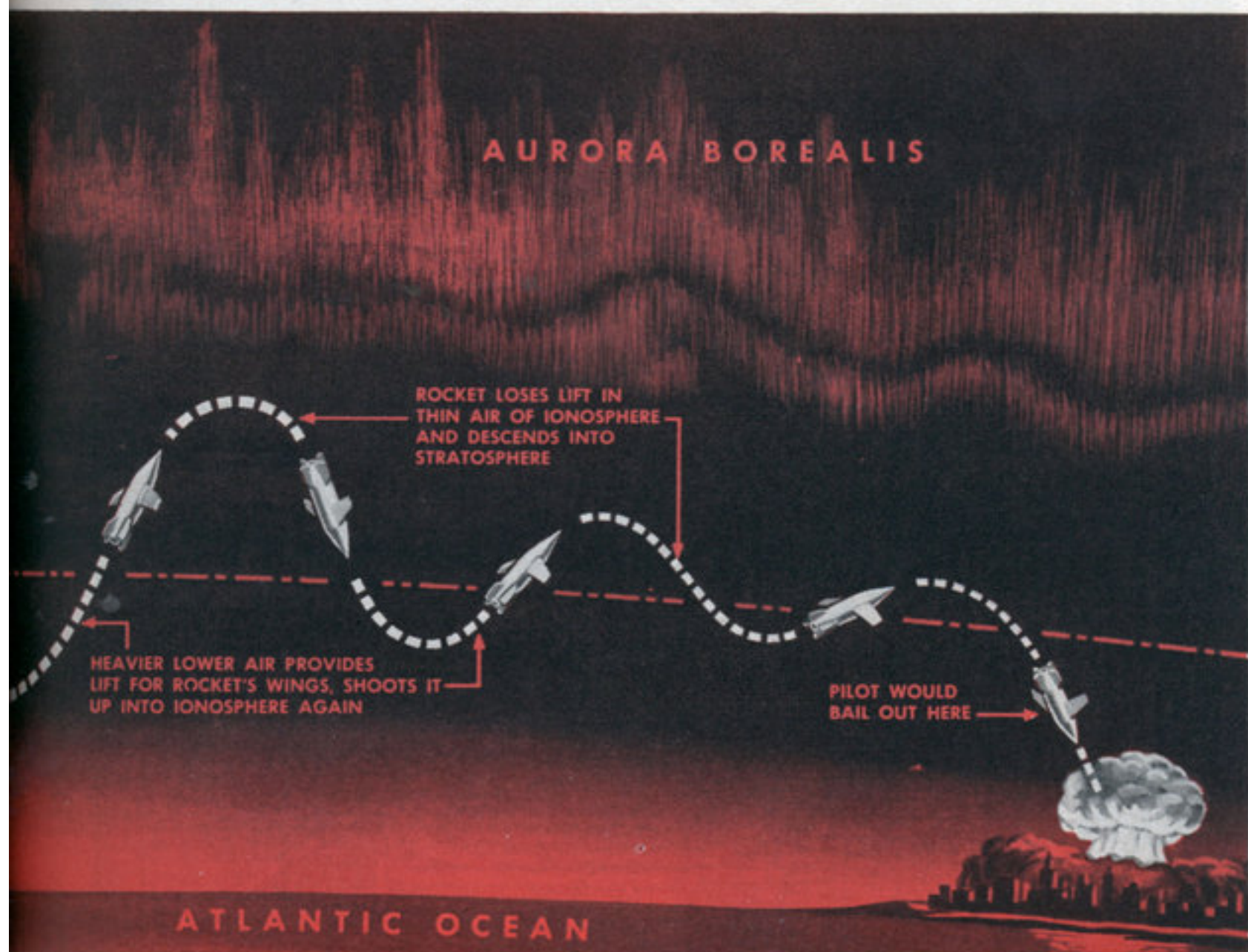
Rocket projects were Hitler's equivalent of America's Manhattan District Project. Blueprints for atomic bombs are still tightly guarded secrets, but the Nazis' detailed

plans for push-button, transoceanic war have now been exposed. They are a clue to developments that may reasonably be expected if there is another war.

If the invasion of Europe had been delayed six months, German robot missiles and piloted rocket bombers would have been hurtling across the Atlantic. Rocket bombing of New York was scheduled for early 1946.

In 1943 Germany's top scientists were

Hitler's blueprints found; mighty winged missiles were to be used in 1946.



Rocket bomber, planned as next step, was to follow this path, drop bombs, and then land.

Designed to Bomb U.S.A.

drafted for work on the A series of guided and piloted rockets. The first three of these rockets were designed for basic research in aerodynamics, airframes and propulsion. The first "commercial" model was the A-4, better known to us as the V-2, which made its devastating debut on British soil on September 8, 1944.

The A-4 was a product of the A series far enough advanced to market death while Hitler's scientists developed deadlier and

more far-reaching missiles. Next came the A-5, which was only one-half the size of the A-4. It was used for experiments in new control mechanisms. This was followed by the A-6, designed for tests at supersonic speeds.

But range was what the Nazis wanted—range to reach the United States. And wings would have given it to them. Wings would permit a rocket, after achieving maximum speed and altitude, to skim and skip between

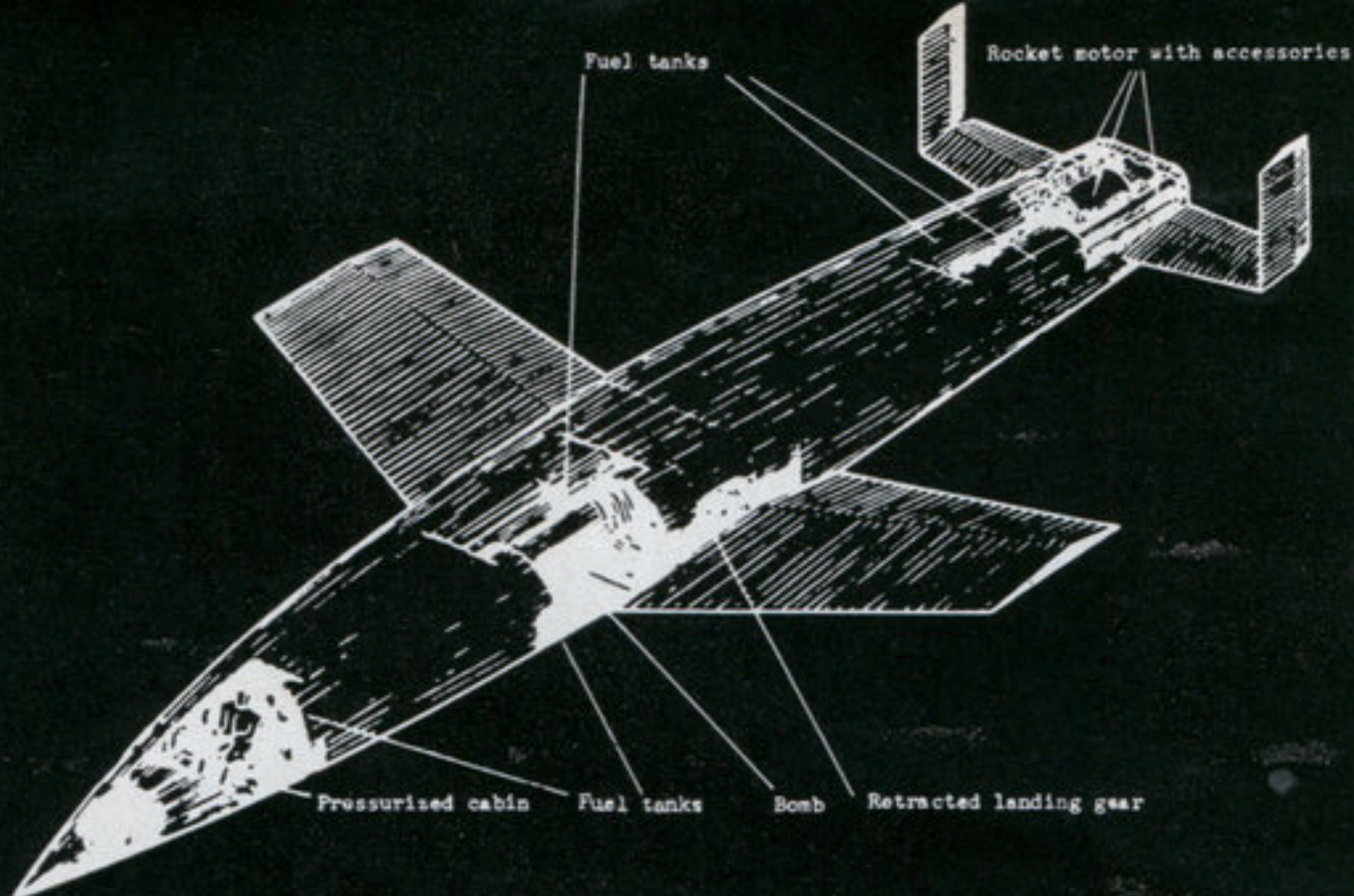


Fig. 58 - Sketch of German Long-Range Rocket Bomber

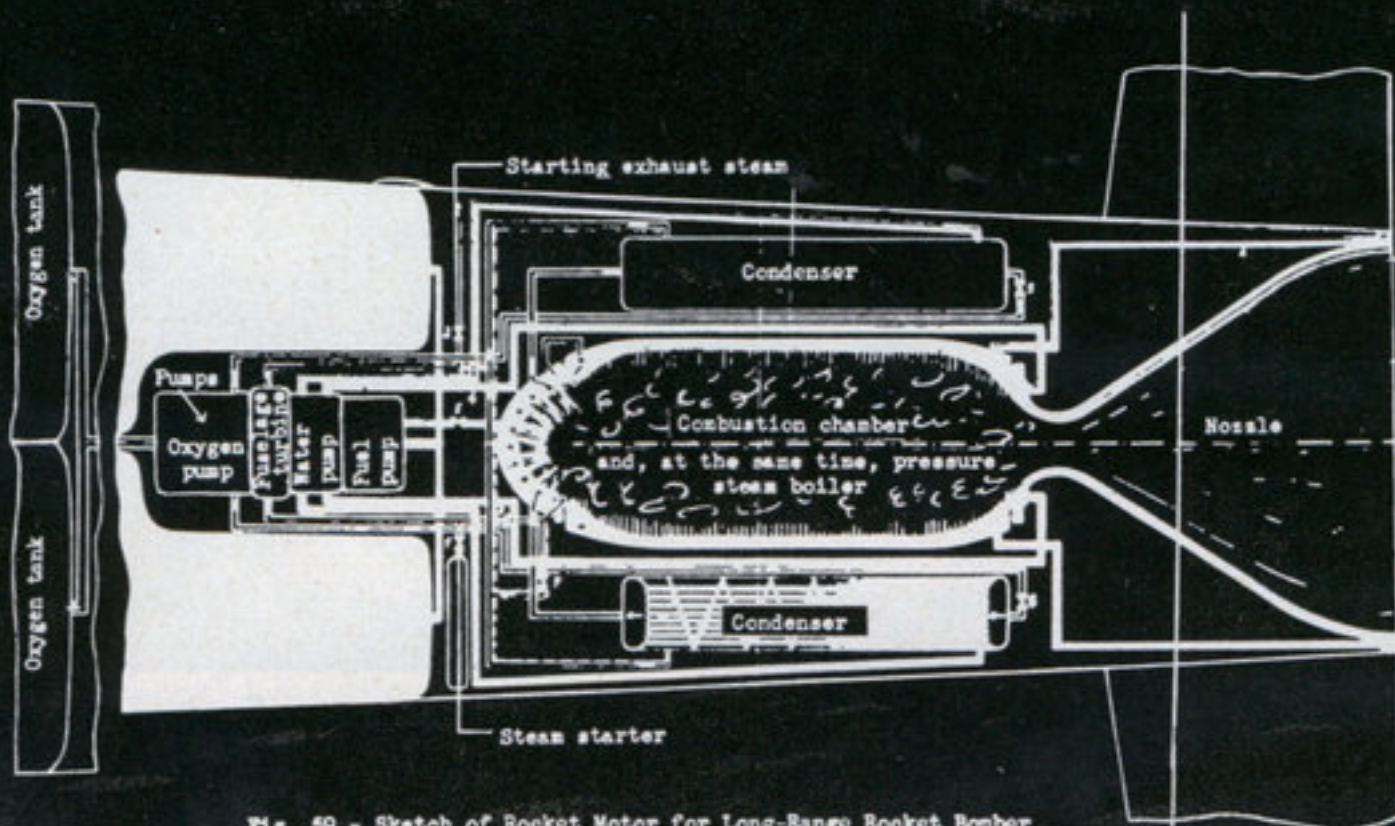


Fig. 59 - Sketch of Rocket Motor for Long-Range Rocket Bomber

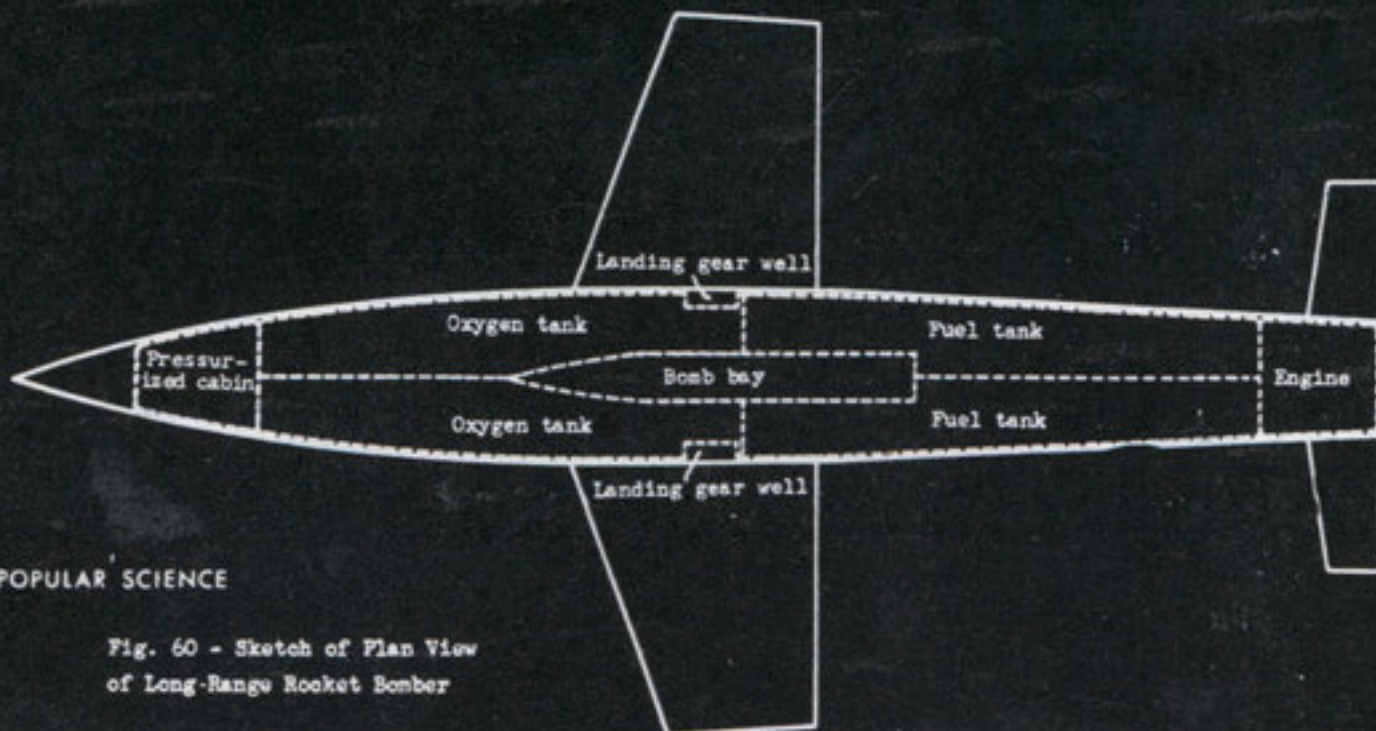


Fig. 60 - Sketch of Plan View of Long-Range Rocket Bomber

Phonograph Disks Run Crewless War Tank

Machines can execute complicated maneuvers and return after their mission has been performed

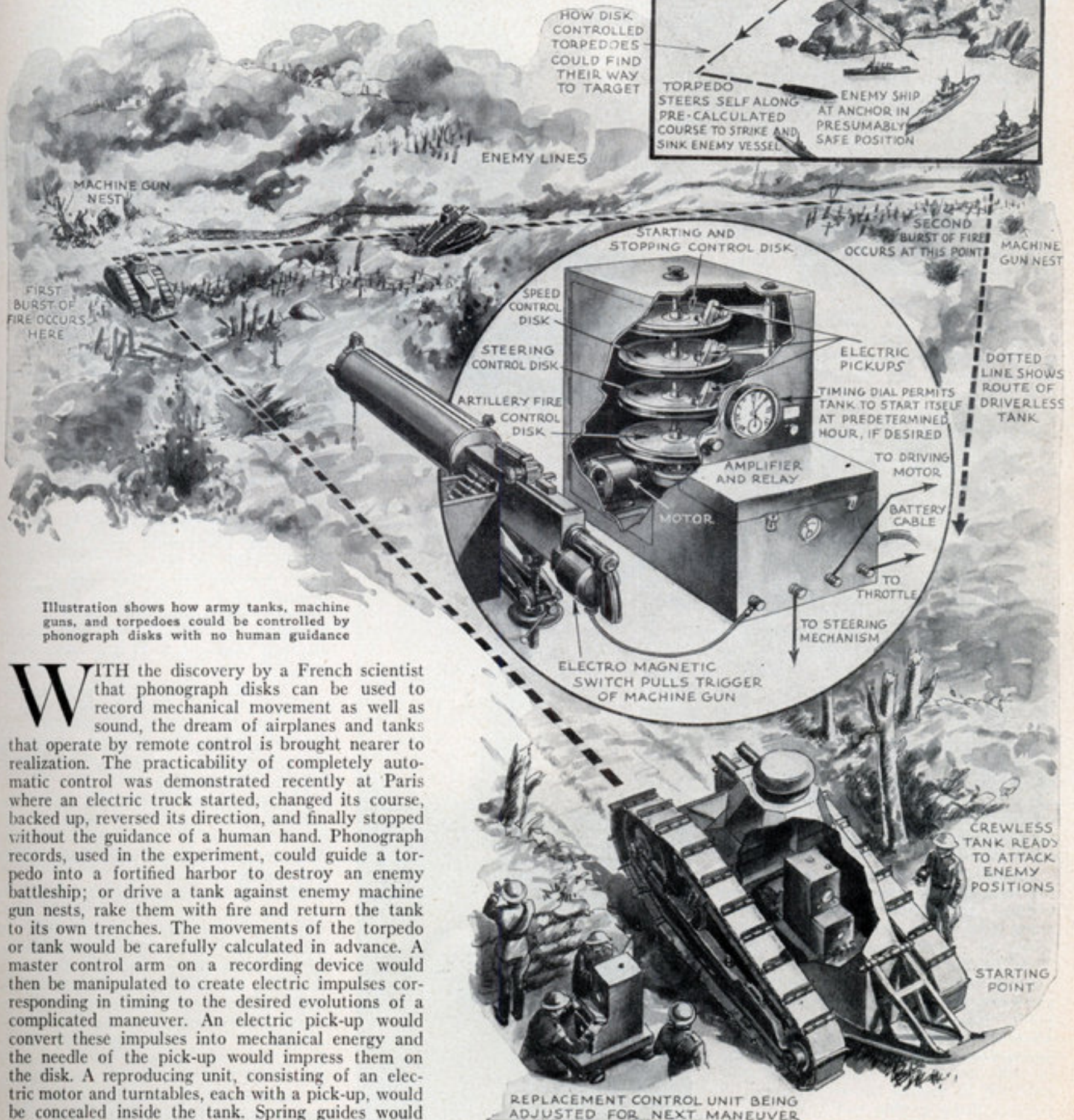


Illustration shows how army tanks, machine guns, and torpedoes could be controlled by phonograph disks with no human guidance

WITH the discovery by a French scientist that phonograph disks can be used to record mechanical movement as well as sound, the dream of airplanes and tanks that operate by remote control is brought nearer to realization. The practicability of completely automatic control was demonstrated recently at Paris where an electric truck started, changed its course, backed up, reversed its direction, and finally stopped without the guidance of a human hand. Phonograph records, used in the experiment, could guide a torpedo into a fortified harbor to destroy an enemy battleship; or drive a tank against enemy machine gun nests, rake them with fire and return the tank to its own trenches. The movements of the torpedo or tank would be carefully calculated in advance. A master control arm on a recording device would then be manipulated to create electric impulses corresponding in timing to the desired evolutions of a complicated maneuver. An electric pick-up would convert these impulses into mechanical energy and the needle of the pick-up would impress them on the disk. A reproducing unit, consisting of an electric motor and turntables, each with a pick-up, would be concealed inside the tank. Spring guides would keep the pick-up needles in their proper grooves on the records. Four disks would be used. One would start and stop the tank and another would steer it. Another record would control the tank's speed and a fourth would aim and fire the machine gun. Detecting the orders carried on the disks, the pick-ups would translate them into electric energy and pass them on to amplifier and relays. Greatly amplified, the current would be carried by cables to electromagnets which would

operate the clutch, throttle, and steering gear of the tank and fire the machine gun. A pilotless airplane, similarly equipped, could fly mails across the Atlantic in a few hours. An automatic stabilizer would keep it on a straight course in full flight and a parachute would enable it to land. At a point previously determined, the engine would cut out and the parachute open, bearing the plane safely to earth at its destination.

EIGHT-MAN CREW
OPERATES PLANE

SEATS ACCOMMODATE
PARTY OF 24



RADIO OPERATOR HANDLES
PRESIDENT'S MESSAGES

Appointments of the new Presidential plane, the *Independence*, make swift travel safe and

"White House" To Roam Sky

Luxurious new *Independence* replaces the travel-worn *Sacred Cow* to speed President's aerial travels.

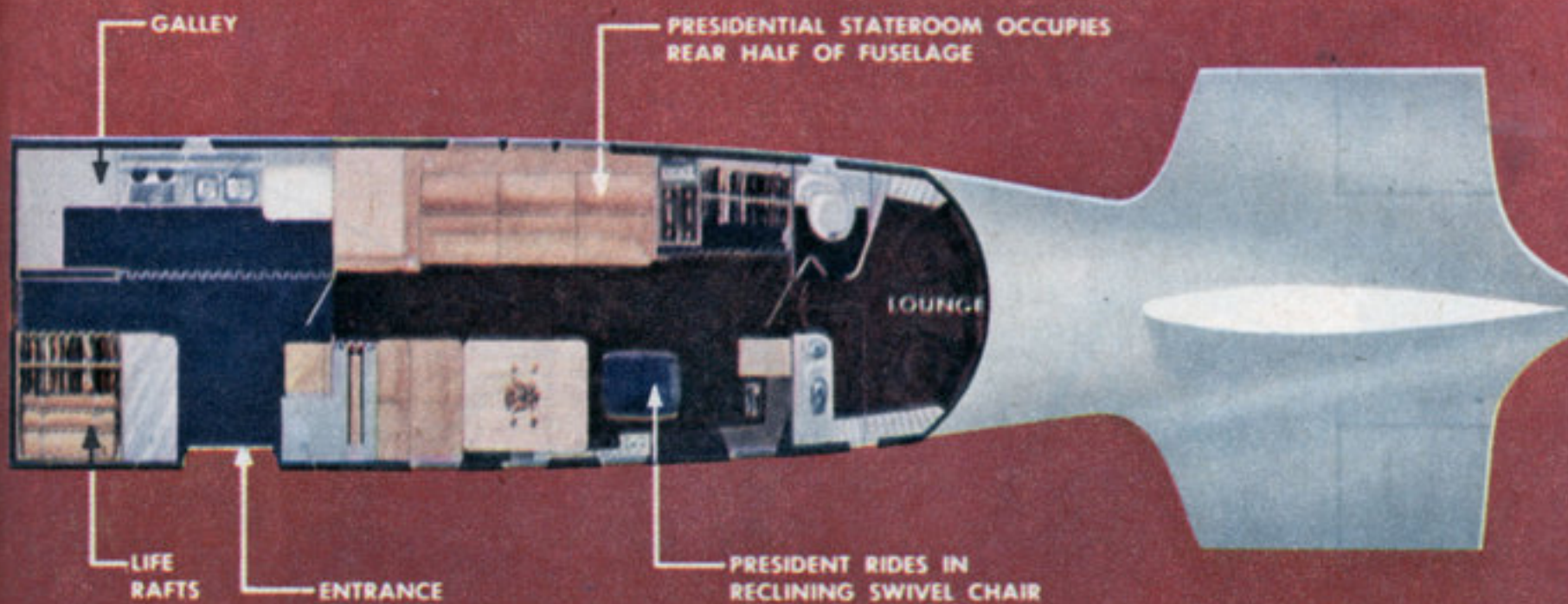
Safety devices of every known type include a special airborne radar installation, with orange screen at center of panel on which terrain may be observed in spite of fog.

WHEN the President of the United States travels, a 315-mile-an-hour plane speeds him swiftly and safely to his destination.

Named the *Independence*, after President Truman's home city in Missouri, the special new Douglas DC-6 cruises 100 miles an hour faster than the *Sacred Cow*, the DC-4 that carried Presidents Roosevelt and Truman and other high officials to 55 nations in trips totaling 431,000 miles. Extra gasoline tanks give the *Independence* a range up to 4,400 miles, and a pressurized cabin permits high-altitude flight. A blue-and-tan exterior design, representing the American eagle,

Teletypewriter set automatically codes and decodes confidential radio messages between the President and his cabinet advisers in Washington. It has range up to 3,000 miles.





comfortable for the Chief Executive and his party. A crew of eight mans special DC-6.

outwardly distinguishes the flying White House from other craft of its type.

Navigating equipment includes every known safety aid. A special radar set gives a constant view of fog-hidden terrain, while a radio altimeter, taking echo soundings, precludes danger of collision with mountain peaks. When making overwater flights, the plane carries life rafts and life-preserver vests.

The handsomely furnished Presidential stateroom occupies the entire fuselage aft of the entrance door. The President's swivel reclining chair faces a mahogany conference table inlaid with the Great Seal of the

United States. A telephone handset and controls of a concealed radio put the world's capitals at his fingertips. He may also exchange confidential messages with his cabinet advisers in Washington by radio teletype, which scrambles the messages to prevent unauthorized interception. Across the cabin, a large built-in sofa becomes a full-sized bed at night. A lounge aft of the stateroom serves as a dressing room.

Passenger accommodations provide upper and lower berths for 12 persons, or seats for 24. A galley with electric stove and electric refrigerator serves the Presidential party hot meals aloft. END

Navigator may call weather stations anywhere on earth for up-to-minute data. Instruments above vacuum jug include altimeter, radio compass and air-speed meter.

The crew of the *Sacred Cow*, former Presidential plane, will also fly the new *Independence*, shown below. Eagle's-head design in blue and tan decorates four-engine craft.

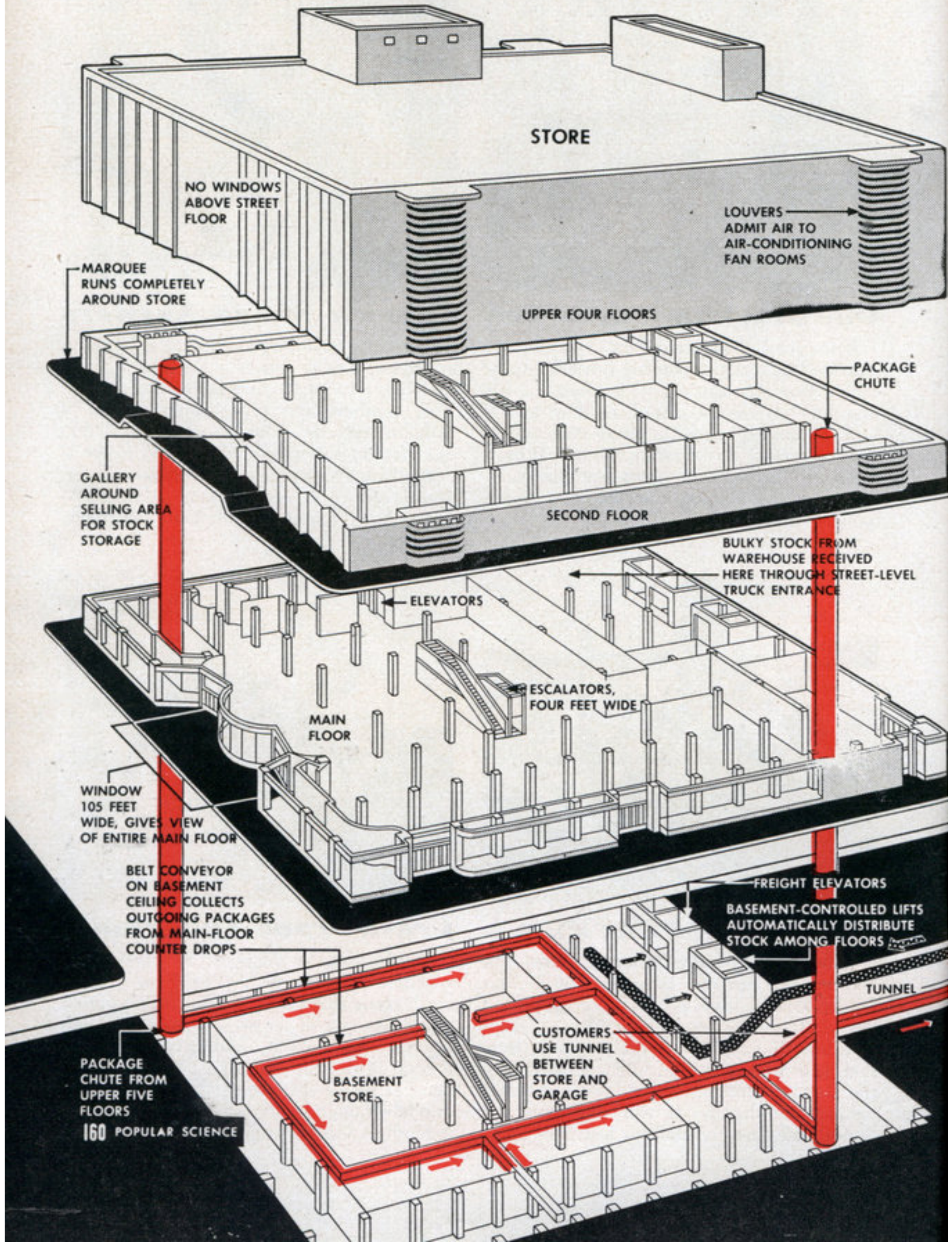


Kodachromes by Lew Nichols



Tomorrow's Store

Foley's is designed to channel the flow of incoming stock and outgoing customers and purchases with maximum efficiency.

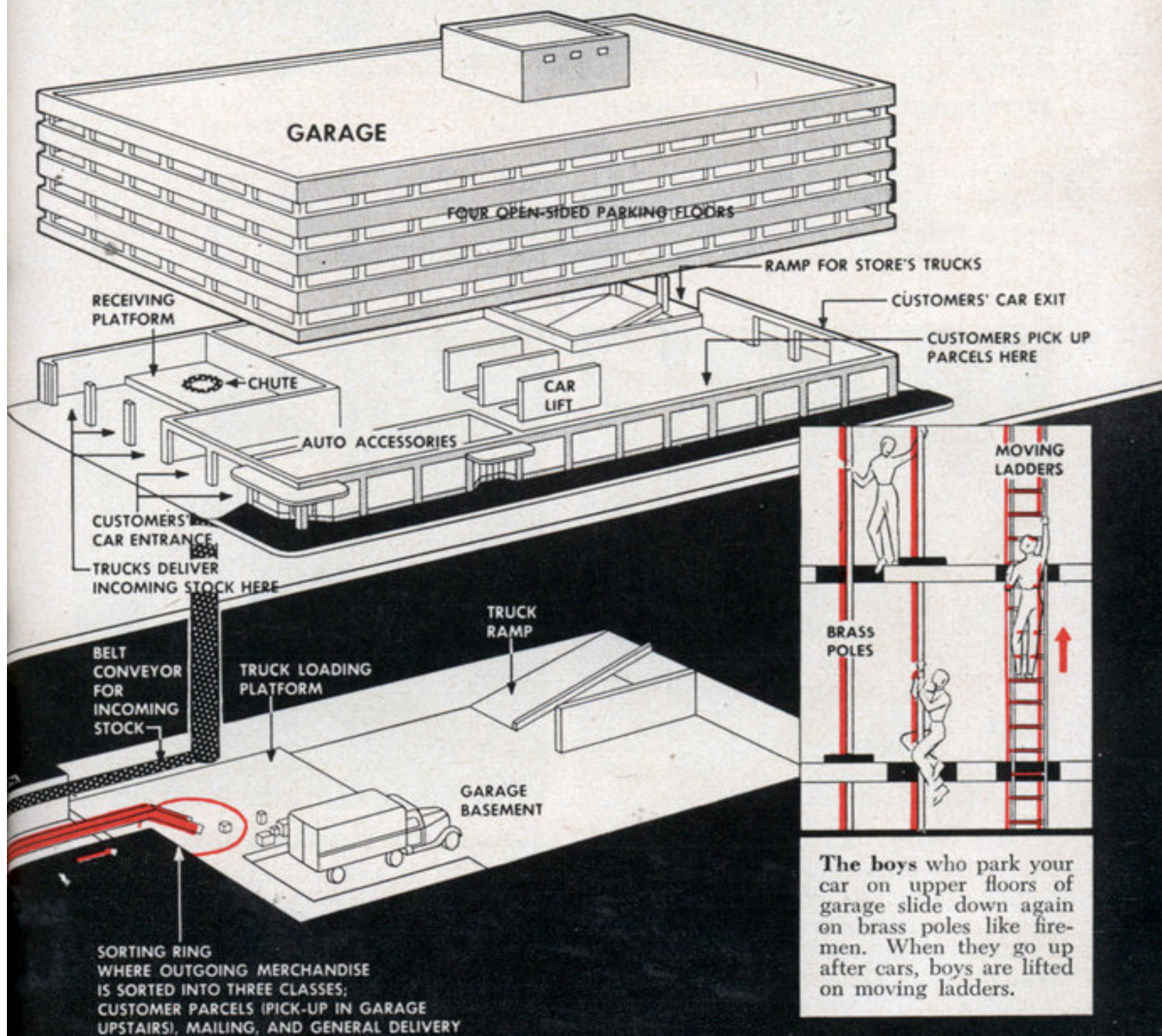


Today

DOWN in Houston, Texas, is what is said to be the most modern department store in the world. Foley's is carefully planned to speed the flow of customers and merchandise. Shoppers park their cars in the garage and walk through a tunnel to the store. All purchases go down a chute to the basement and travel on a belt conveyor to the sorting ring in the garage. Each customer's bundles are waiting for him when he is ready to drive out. The ten-million-dollar store is six stories high, but it has been so built that six more stories can be added if business increases and more space is needed.



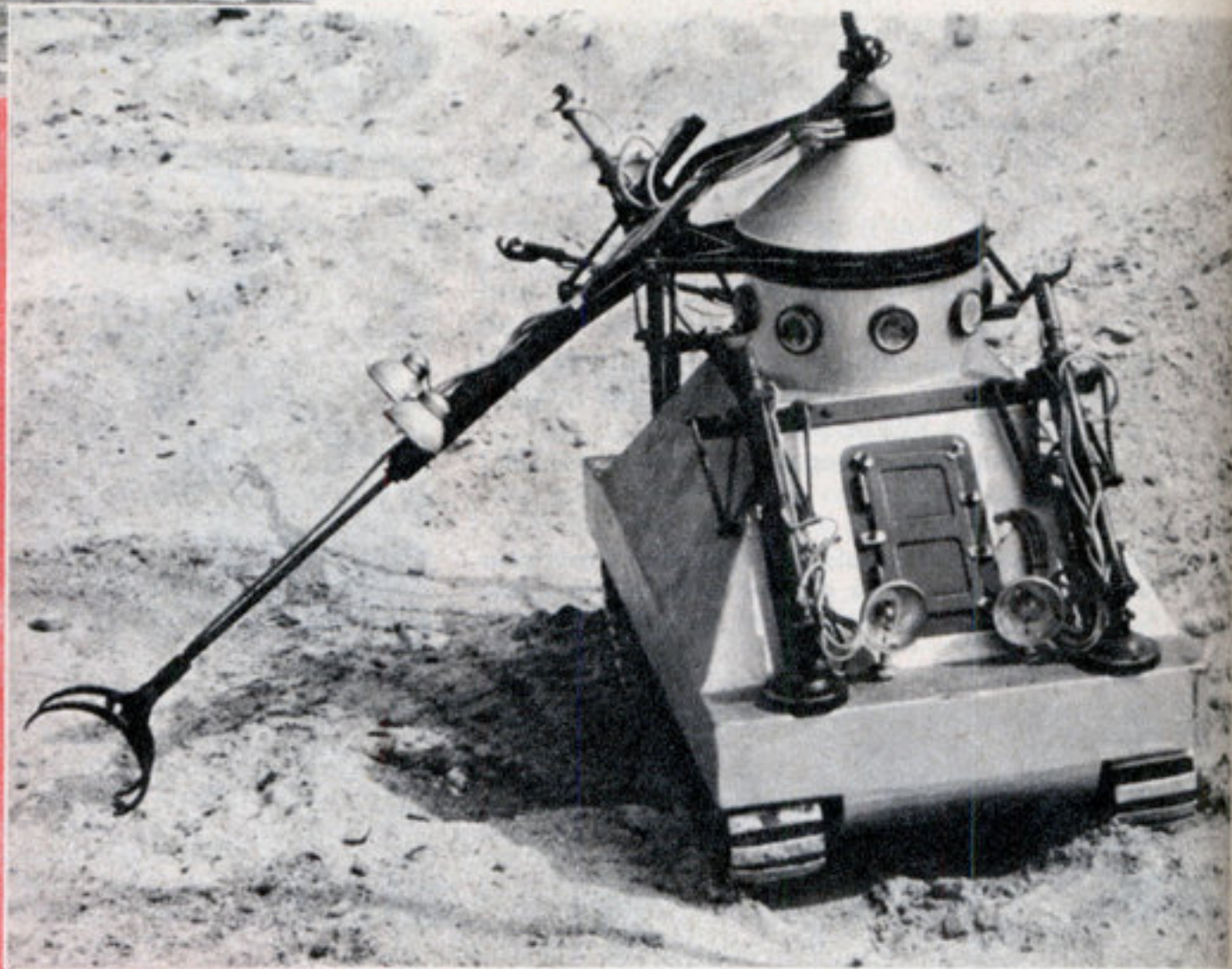
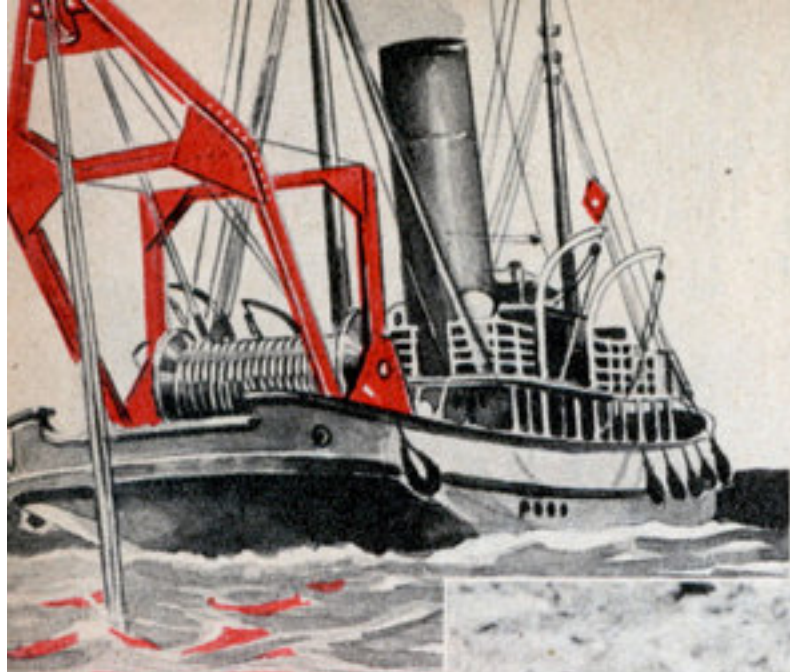
There are no windows in Foley's except for main-floor displays. Air conditioning provides ventilation; all lighting is artificial.



The boys who park your car on upper floors of garage slide down again on brass poles like firemen. When they go up after cars, boys are lifted on moving ladders.

Mechanical

Deep undersea the claws of this tank will rip to the heart of rotting treasure ships.



THERE'S gold down on the ocean floor. Vast fortunes lie hidden in sunken caches, waiting the hand bold enough to stretch down through the dark pressure-packed waters and bring them to light. Now, with the new ultra-modern equipment becoming available, treasure expeditions may become big business.

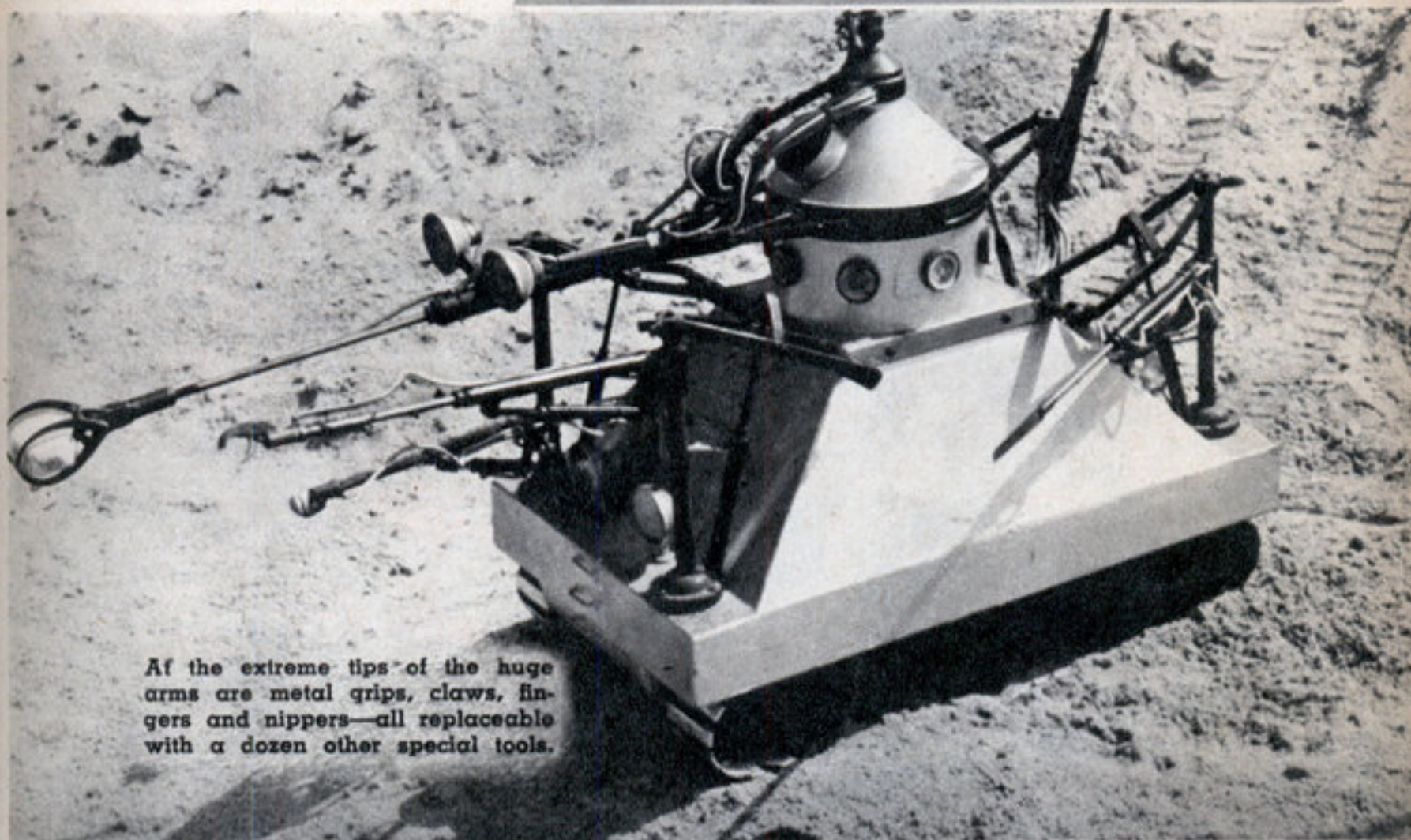
Treasure salvors know the authentic accounts of divers who have recovered immense treasure from sunken galleons, and know too of numerous other sunken craft that still retain great wealth within their rotting hulks. I myself have salvaged many sunken vessels, bringing to the surface much treasure; I, too, have attempted to recover some of the Spanish treasure that remains beneath the Silver Shoals, off Haiti; and I have walked in the sunken city of Port Royal, the fabulously wealthy "Pirates' Babylon" off Jamaica.

I am positive that there are many more

Mechanix Illustrated

"Lobster"

BY LT.
HARRY E. RIESEBERG



At the extreme tips of the huge arms are metal grips, claws, fingers and nippers—all replaceable with a dozen other special tools.

golden doubloons and pieces-of-eight to be had from numerous wrecks on which I have done intensive research; but I have long known, too, that to reach those riches, and others as well, there must be stronger and more efficient diving equipment.

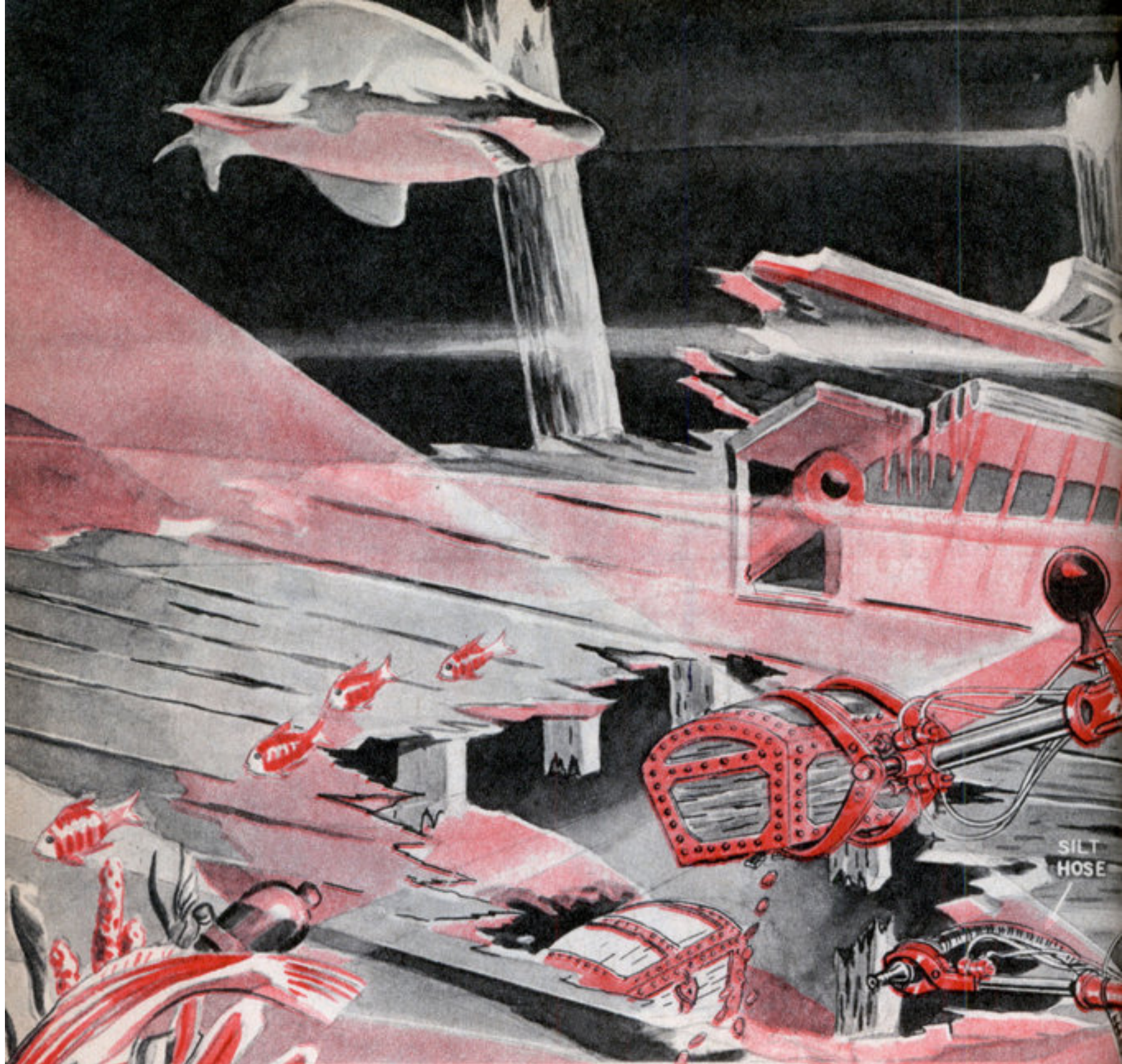
I began turning my attention to the improvement of equipment, bringing to the problem ideas gleaned from my own actual experiences and many narrow escapes from death.

Working with Charles G. Warren, a well-known

November, 1947



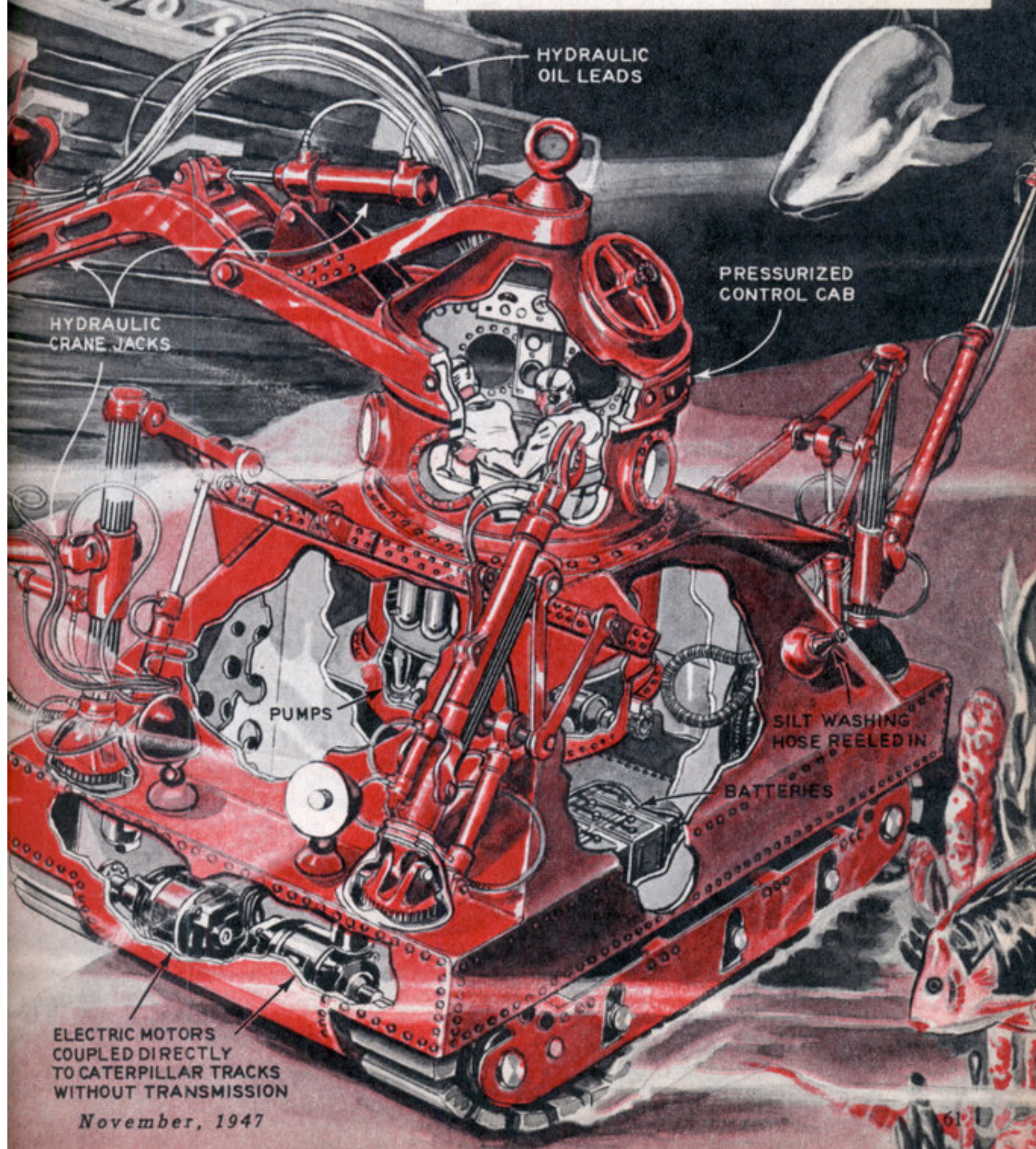
All sorts of complicated operations can be performed by the shorter arms—even the drilling of a 3-inch hole.



mechanical engineer, I invented and perfected a model of an unusual under-water device which we feel is a big step forward. It is a huge tractor-tank vehicle suited to the rigid working requirements at great depths—one which may be driven into the sea from the beach under its own power, or dropped from a salvage craft into the desired location far from land. It is similar to a huge Army tank on caterpillar treads and is operated by powerful electrically-driven motors within sealed chambers. It will travel across the uneven rocky or sandy sea floor at five miles per hour.

Outside there are five gigantic, hydraulically-operated cranes. Four of them, located on the corners, are 15 feet long and made so they can be both folded back or extended to almost any desired length for various complicated operations. A fifth crane, for heavy duty, is mounted on the top of the control compartment; this has a swing of 360 degrees and a reach of 35 feet or more.

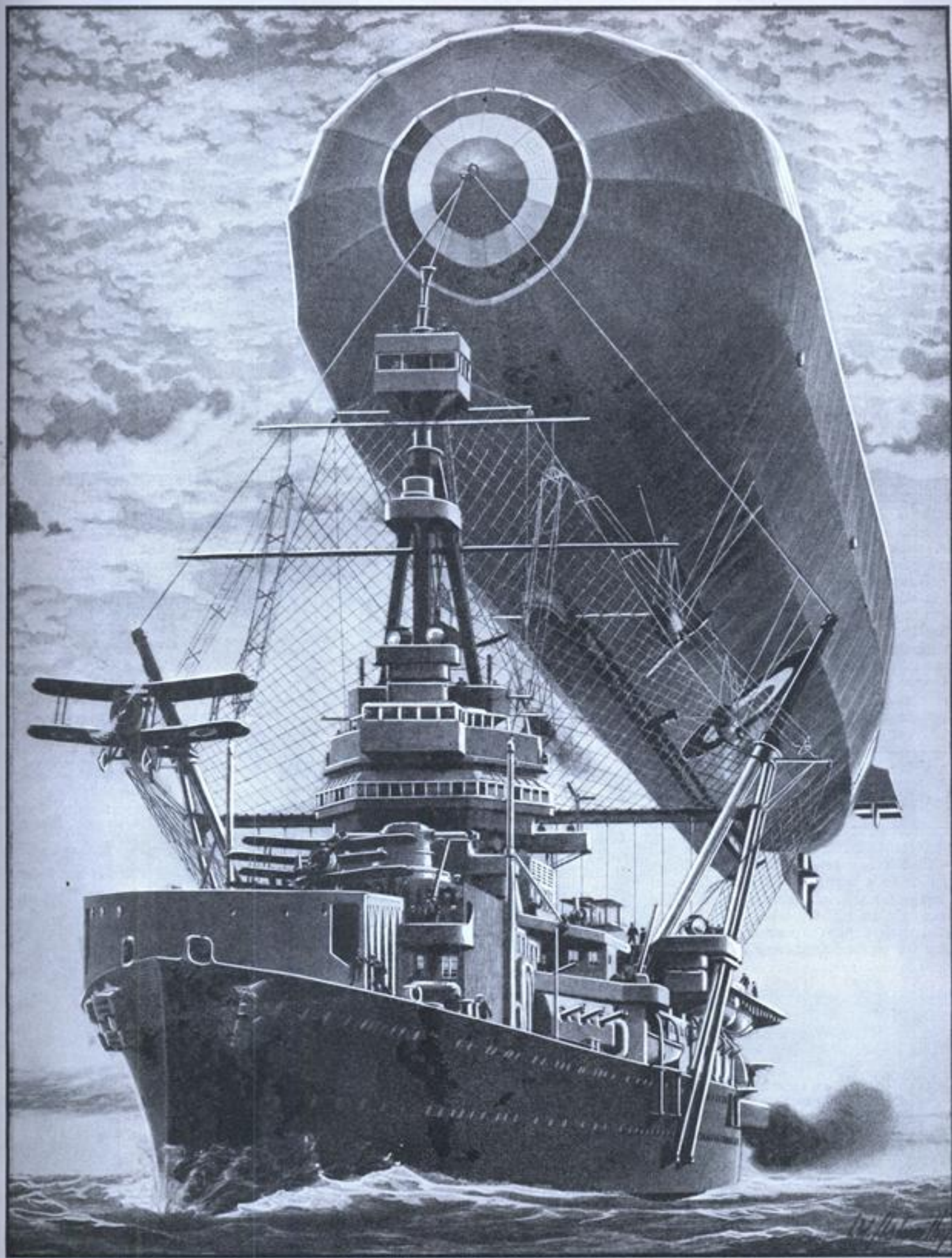
At the extreme tips of these huge arms are metal grips, claws, fingers and nippers, so sensitive and yet strong that very small objects may be picked up from the bed of the ocean, or sections of heavy planking torn from their fastenings on a sunken wreck. With astonishing flexibility these devices can tie ropes or steel cables under terrific water pressure at great depths—far greater than possible with any known mechanical device invented to date. They are detachable and interchangeable, being easily replaced by a dozen other special instruments for the many [Continued on page 169]



ELECTRIC MOTORS
COUPLED DIRECTLY
TO CATERPILLAR TRACKS
WITHOUT TRANSMISSION

November, 1947

Floating Mooring Mast Proposed as Way Station for Airships



© Popular Science Publishing Co., Inc.

CONVINCED that battle fleets of the future will require the aid of rigid airships as long range scouts, aeronautic experts recently have suggested an ingenious method of mooring rigids to the mast of a moving depot ship at sea, as pictured above.

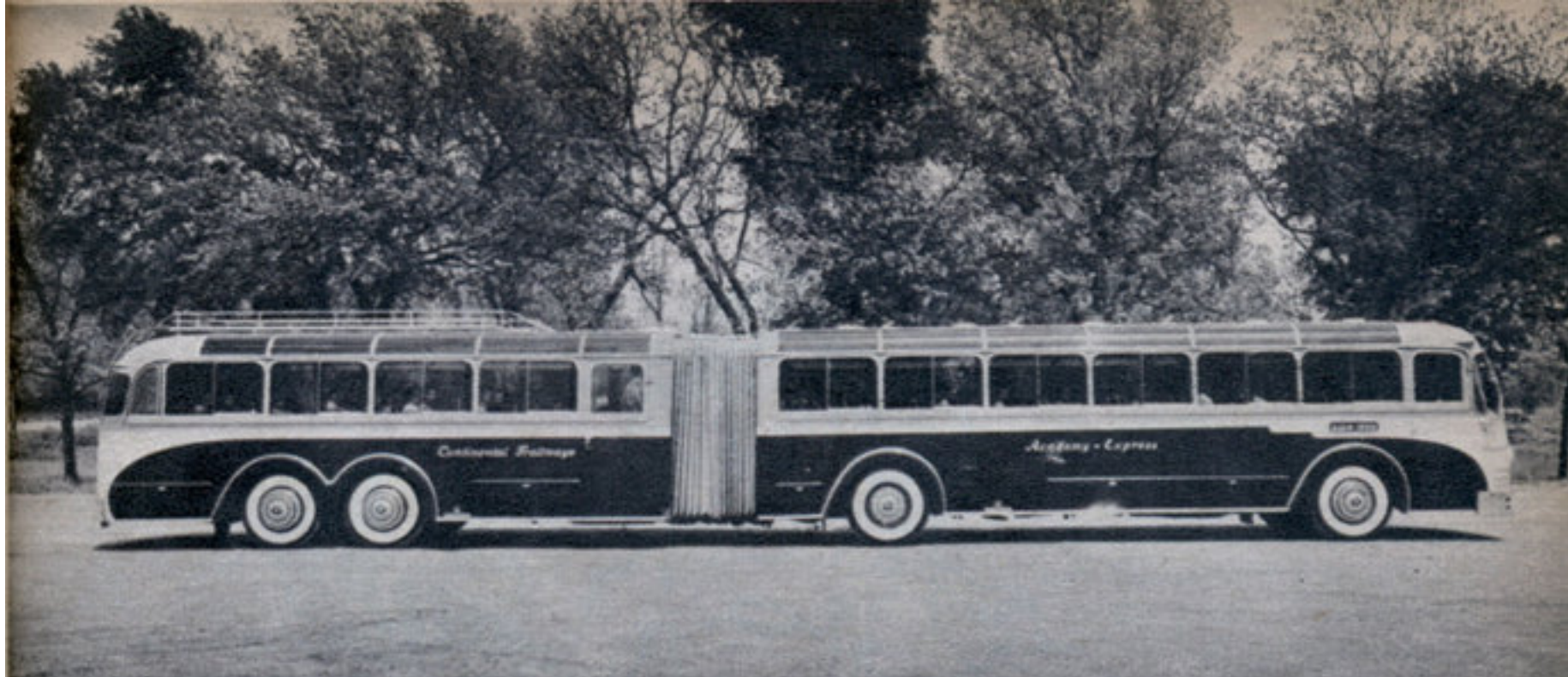
The depot ship, preferably a converted

cruiser, has a hangar forward for small fighting planes, with a launching deck from which the planes are seen taking off to protect the rigid as it returns from a trip.

Topping a raised tripod mast is a mooring device to which the airship is anchored, while projecting from each side of the vessel are other tripods carrying guide ropes that

hold the airship's bow in position as its nose cone is hauled down to the mooring device.

Immediately behind the mooring mast is stretched a wire curtain to prevent planes from overrunning the great landing deck seen projecting above the boiler smoke ducts aft. Above this curtain is network to catch the mooring ropes when cast loose.



SIXTY-FOOT BUS needs less room to turn than regular 35-foot type.

BENDABLE BUS IS B...I...G!

New accordion-pleated bus provides lush comfort, hostess service and free lunch.



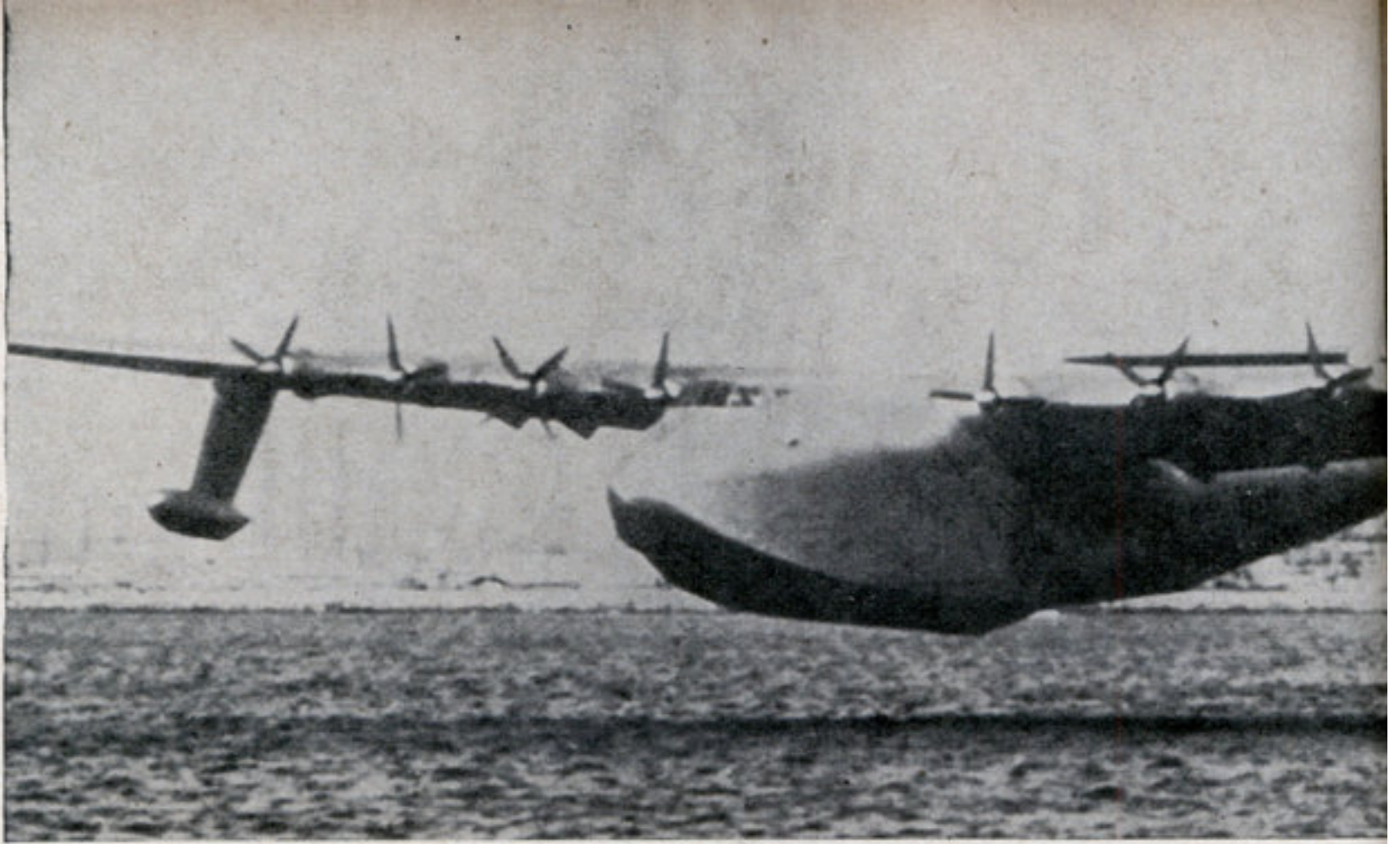
LOTS OF GLASS means lots of view and lots of light and a happy-looking interior.

LIGHTWEIGHT steel-aluminum coach uses an American-built Cummins Diesel engine.

OLD travelers over the Denver-Pueblo bus route are in for a big surprise on their next trip unless they've been reading about Continental Trailways' new German coaches that bend in the middle, offer free refreshments, a rolling rest room, music and hostess service. Typical of the luxury coaches of Europe, the buses open a new era in bus travel in this country. •

HOSTESS serves free snacks to passengers from compact galley located amidships.





World's Biggest Plane Makes



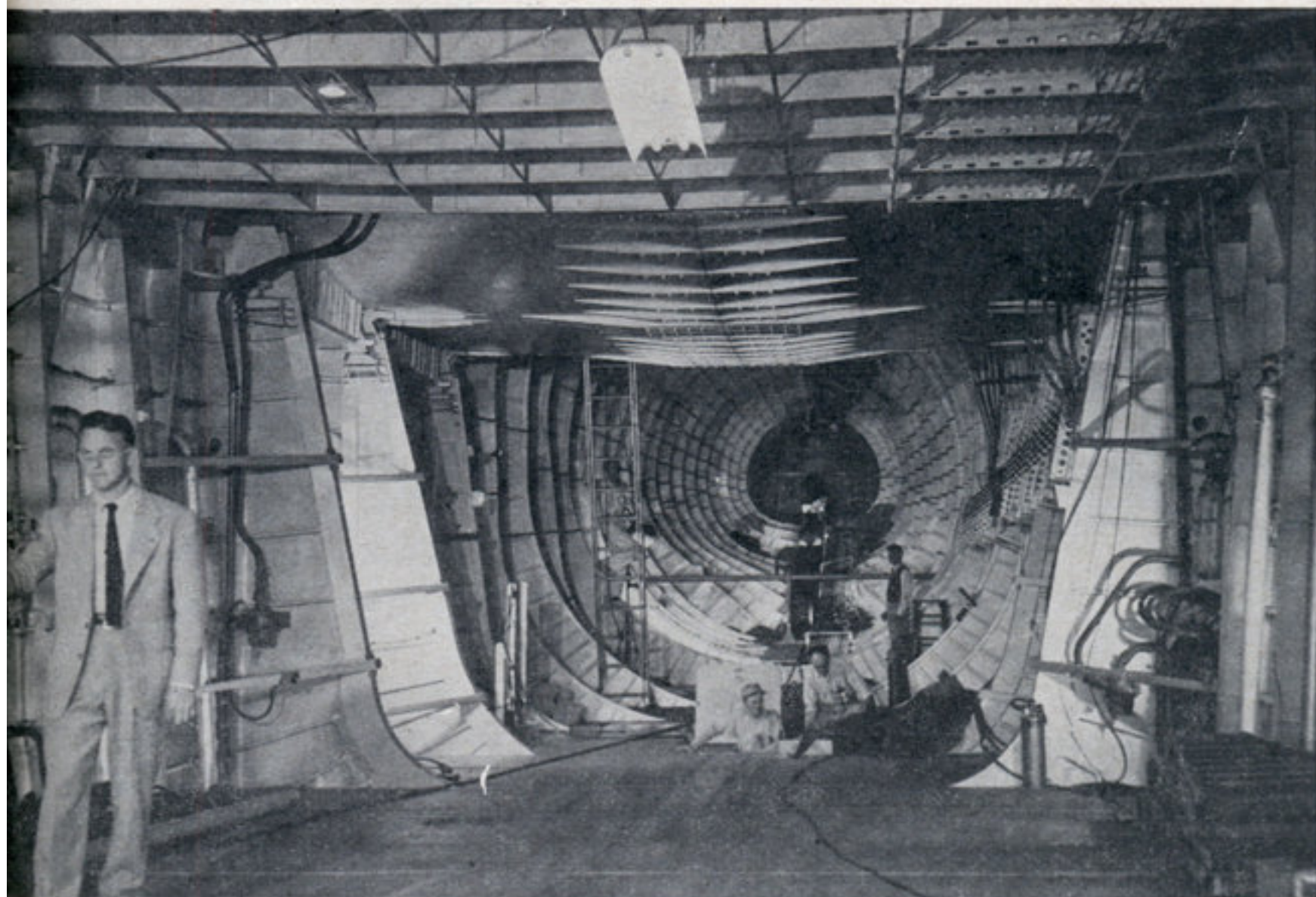
View forward on flight deck of 400,000-lb. flying boat shows upper level of nose. In back-

ground Hughes discusses plans for taxi test with flight engineer and radio operator.



First Flight

The biggest airplane in the world, Howard Hughes' huge flying boat, has taken to the air at last. Hughes himself, shown above at the controls, unexpectedly lifted the big ship between 70 and 80 feet in the air during a taxi test in Los Angeles harbor.



Workmen dwarfed by huge center section of \$25,000,000 plane give idea of vast size. Its

wing span is 320 feet; length, 219 feet. Plane hit 100 m.p.h. during first test.

Manhattan's \$300,000

Roofs of metropolitan skyscrapers are now the most sought-after and expensive sites for exclusive apartment dwellings. Rentals for some of the roof houses range around \$2000 per room per year!

I HAVE heard much about New York penthouses lately. Thinking of a penthouse as a little shack on a dingy roof, I asked a realty friend to show me one.

I found the building whose number he had given me. The building and elevator shaft proved pleasantly cool. And to my

surprise, when I stepped off at the 13th floor and into the vacant penthouse, it also was cool as compared to the street. Delightful breezes, which never touch street level, carried the heat away. The roar of heavy traffic below was greatly subdued.

So was I, for that matter, when the "little shack" turned out to be a ten-room mansion in the sky. On the roof level were three large, high-ceilinged living rooms, each with fireplace, cavernous closet and French doors to the tiled roof outside. There was a solarium for sunbathing. And on the floor below were three master and four maids' bedrooms.

At this high point in my reflections the agent on premises stepped into the picture, hot on the trail of

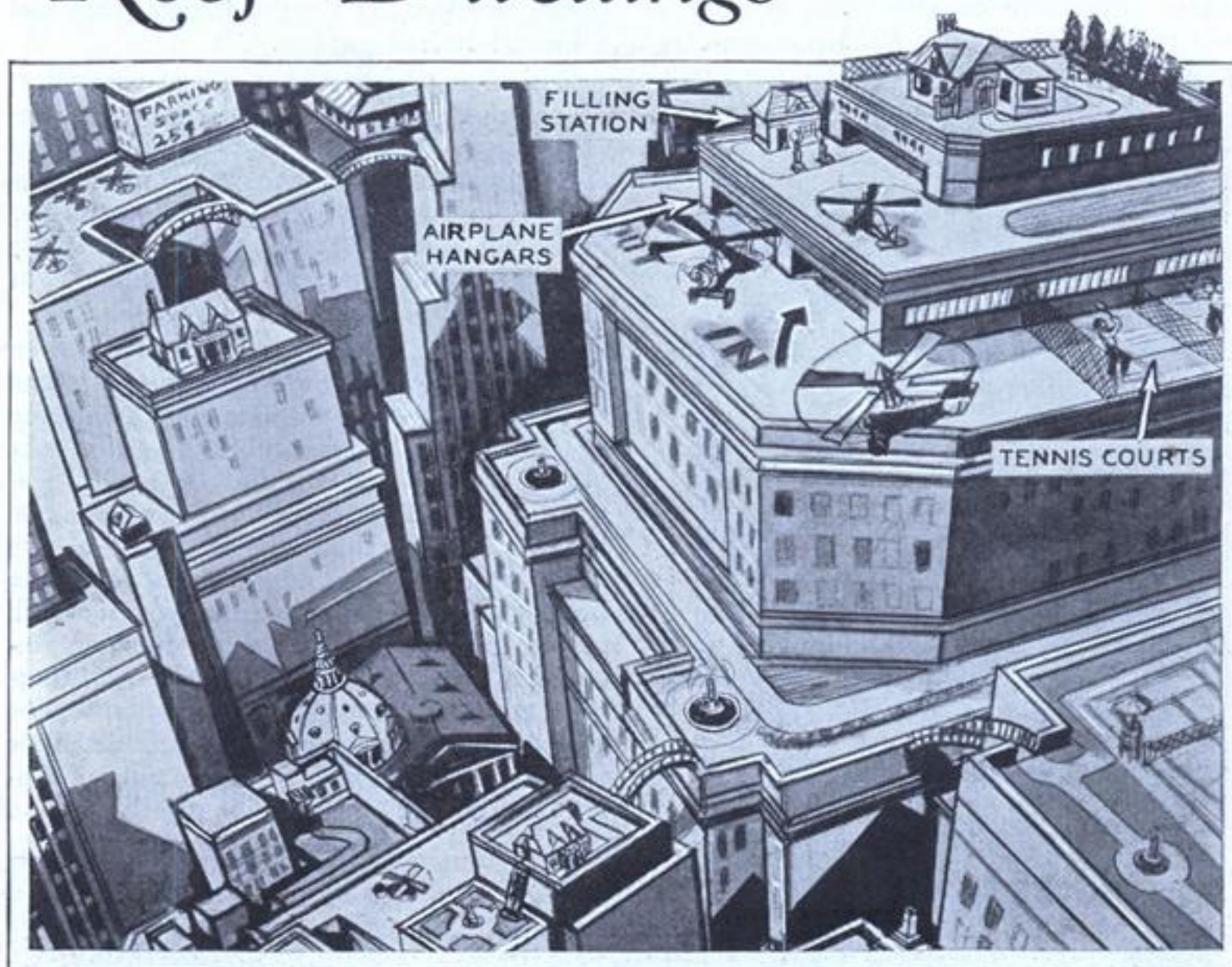


All the comforts of a suburban home are provided in the latest roof apartments. Trees and shrubbery can be grown in the three-foot layer of soil spread over a roof, as shown in the above photo. The inset picture shows how household furniture can be fitted into a small space by using a sink which is also a table and a bath tub. These apartment dwellers live far above the noise of city streets.

Roof Dwellings

By ORVILLE H. KNEEN

The Story of the
Penthouse Apartment



Cities of tomorrow will find the roofs of buildings just as important as interior space. The artist's conception of such a city, shown above, indicates how tennis courts, airplane landing fields, gardens, residences will be disposed atop skyscrapers. Bridges connect buildings on different streets.

a prospect. As this seemed to be me, I asked him casually what I might rent the little dwelling for.

"These are not for rent," he said. "This is a cooperative dwelling, for sale only. I could let you have it as is for \$142,000, not including upkeep, which is at the rate of 9 $\frac{1}{4}$ per cent. I think you can get a larger one up the avenue, with four rooms more, for \$181,000 . . ."

I hastily assured him that this was quite large enough—that I'd be back as soon as I had consulted my wife. My ardor cooled, I "hot-footed" it back to my realty friend who rents these tiny shacks for one of New York's largest firms.

"You ain't seen nothing yet," he informed me. "Several of the new penthouses on Fifth Avenue have sold for \$300,000 each. Most of these are sold on the plans, before

the building is started, and finished to suit. And we can't finish them fast enough. On the east side alone there are probably 100 under way, on about 65 new apartments. Every building of this type now has from one to four penthouses."

I asked him if he knew of any more available, at more nearly my financial size.

"Oh, yes," he assured me. "There are three and four room penthouses, selling for \$20,000 or \$25,000 up, depending upon the location, etc. If you want to rent, I might be able to get you a small one at \$400 to \$2,000 a room per year, in a modern building. That's only about 20 per cent more than for equivalent apartments on the lower floors."

For various reasons, I have not yet returned to sign up for my penthouse.

Although Babylon had its hanging or

A VISIT INSIDE UNCLE SAM'S *New*

by JAMES NEVIN MILLER

UNCLE SAM'S new gold vault is the greatest and strongest fortress in the world. No fire can harm it. No bomb can damage its mighty walls. The most brilliant cracksmen cannot penetrate its baffling defenses.

Built of steel and concrete whose strength is unbelievable, this giant treasure house is equipped with mysterious passageways, secret doors and an automatic alarm system whose scale is the largest ever conceived by the mind of man.

More than twice the size of the old vault, the new structure is capable of housing all the gold in the United States—three billion dollars in bullion—the greatest concentration of wealth in American history. Erected upon the site of the old vault which was razed a year ago, the new treasure house is literally a building within a building. Nestling in a courtyard, it is surrounded on all four sides by the heavy stone walls of the old Treasury Building.

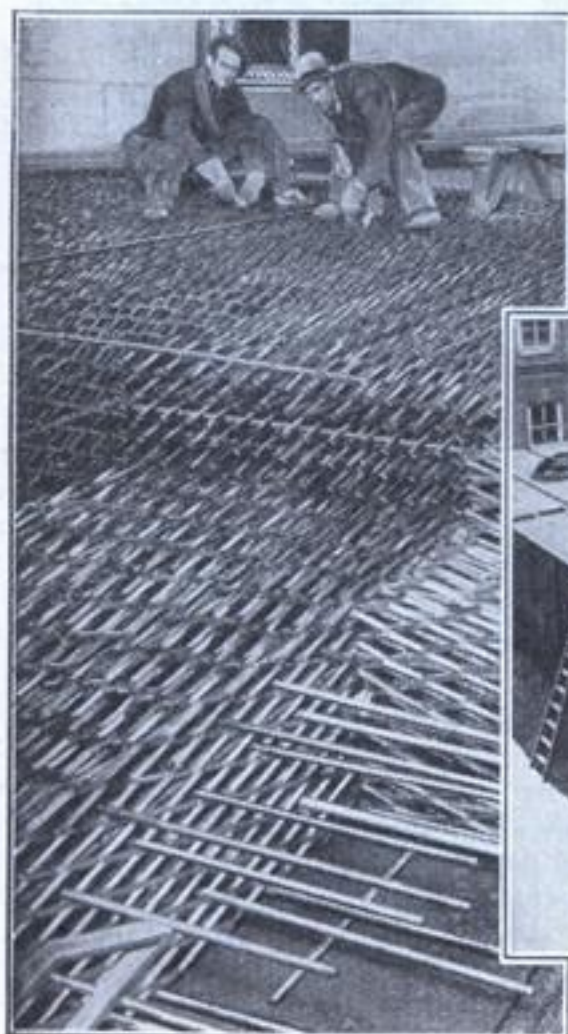
Actually the new vault is two vaults in one, or rather, two major vaults, one located on the lower story and the other on the upper, each in turn divided into sub-vaults. The lower story is sectioned off into

Built to withstand fires, bombs and the raids of super criminals, the nation's newest treasure house is the last word in safety. Here are the reasons why.

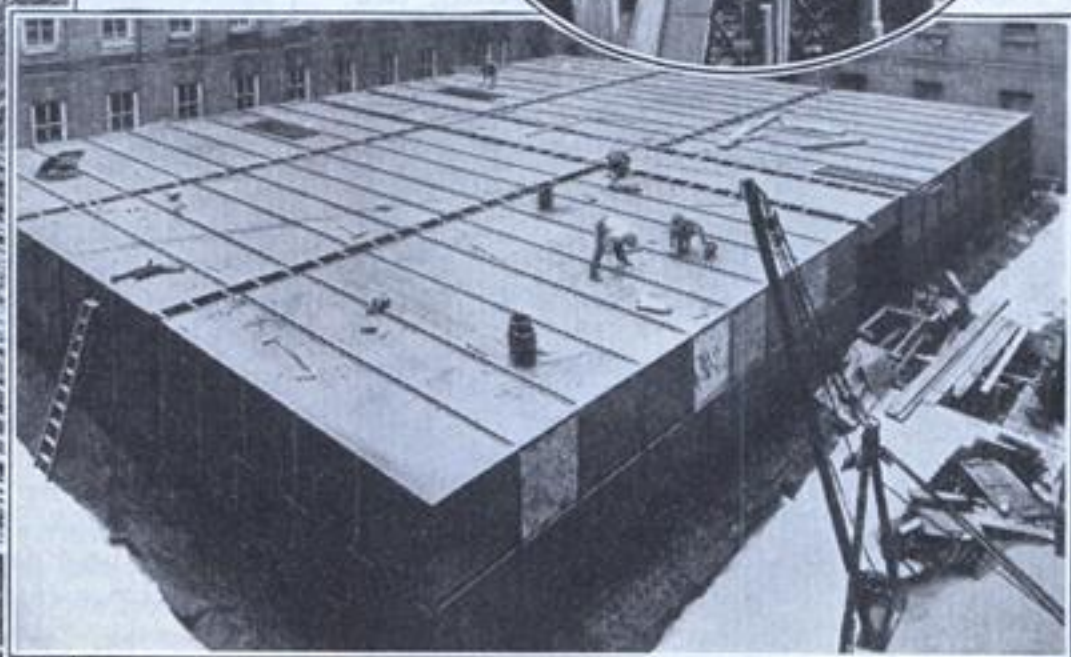
a corridor running through the center and facing at either side on ten sub-vaults.

This story is entered from the sub-basement level on the northeast corner. Facing the entrance is a giant steel door weighing thirty-nine tons. According to Treasury engineers, it would take a dozen of the country's best experts on vault design and construction at least seventy-three hours to penetrate to its insides in case somebody lost the combination.

Assuming that by some near-miracle a safe-cracker did succeed in getting inside this giant door, it would take him at least three days to crack his way, via acetylene torch or compressed air apparatus, into any one of the doors leading into the sub-vaults.

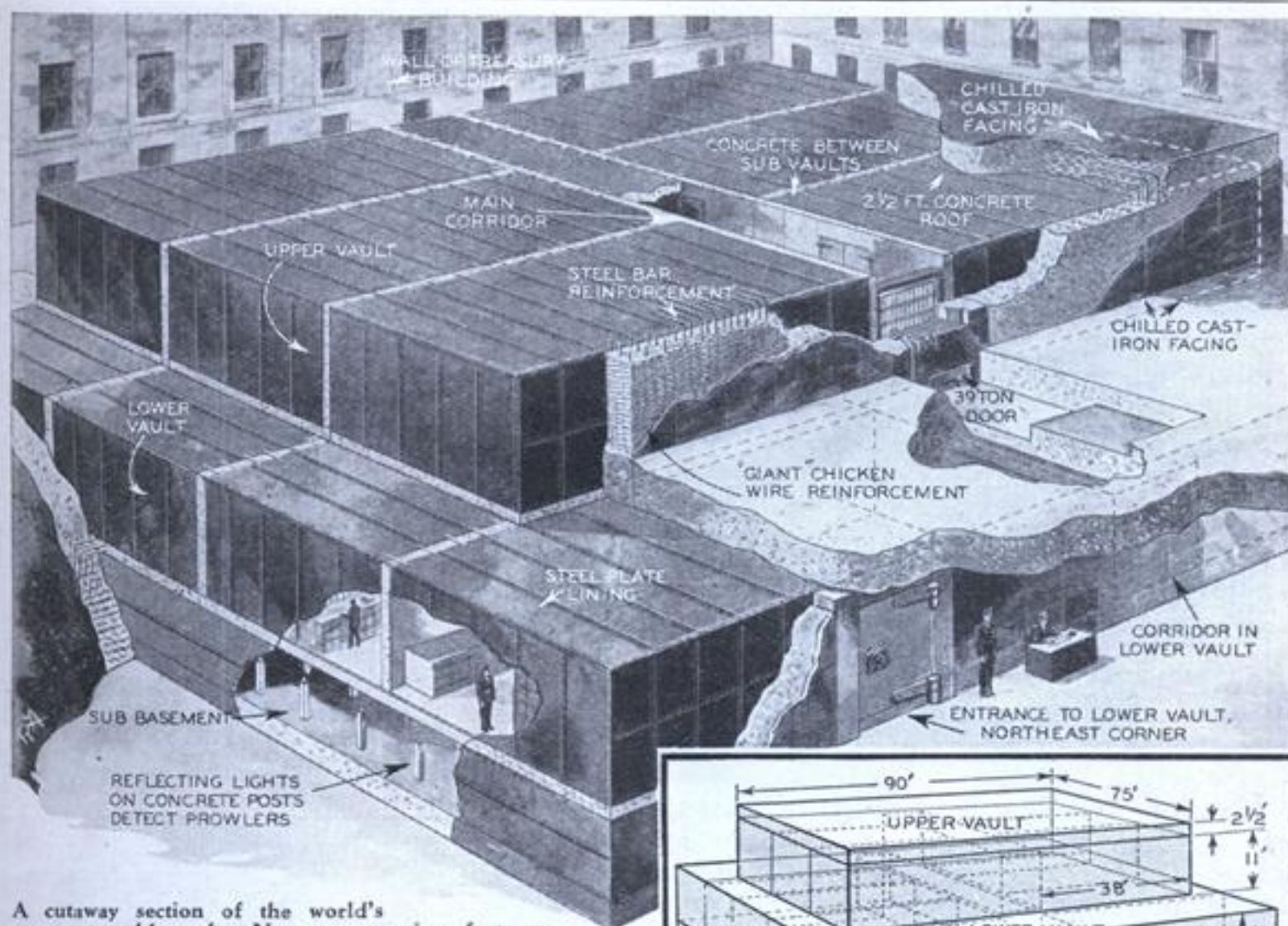


Left, workmen lay a bombproof roof of giant "chicken wire." Right, concrete poured over these steel bars and webbing is later faced with chilled cast iron to form the structure's exterior surface.



Completing the laying of the chilled iron facings. This metal, one of the strongest known, is so hard that it cannot be cut or shaped after it is cast.

GOLD VAULT *Fortress*

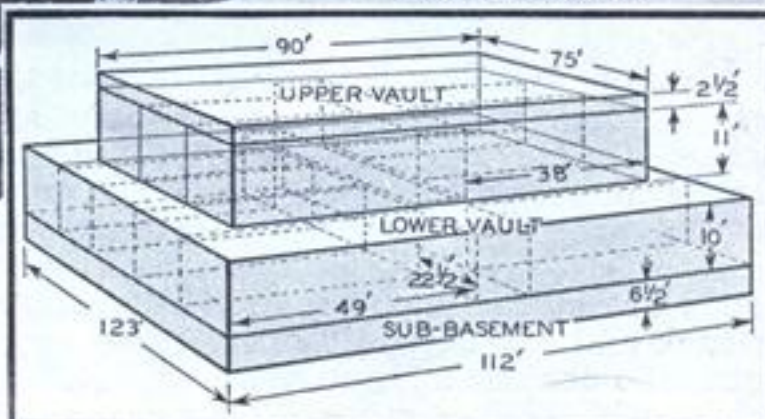


A cutaway section of the world's strongest gold vault. Note construction features and numerous other safety devices which protect America's wealth against bombers, firebugs and marauding thieves.

Each of these latter, by the way, has only one lock; but the door will not open unless two keys are used. These will be carried, it is understood, by two separate guards. Assuming that both these men lost their keys there's a secret emergency entrance to each sub-vault, known only to a chosen handful of Treasury executives.

When the main vault is put into actual use, guards will patrol the corridor night and day. Every sub-vault is air-conditioned and equipped with what is believed to be the most efficient automatic alarm system ever known. Details are naturally not available to the public, but it is understood that if any person so much as touches a door outside of office hours, an alarm will immediately bring secret service operatives and police to the scene instantly.

This lower vault, or story, is almost an exact square, 123 feet by 112 feet. The ceiling is 10 feet high and each sub-vault is 22.6 feet by 49 feet. Somewhat smaller in length and width is the upper story. Instead of ten sub-vaults it has only six. Each is equipped for storing securities, currency or coin, as the emergency may arise.

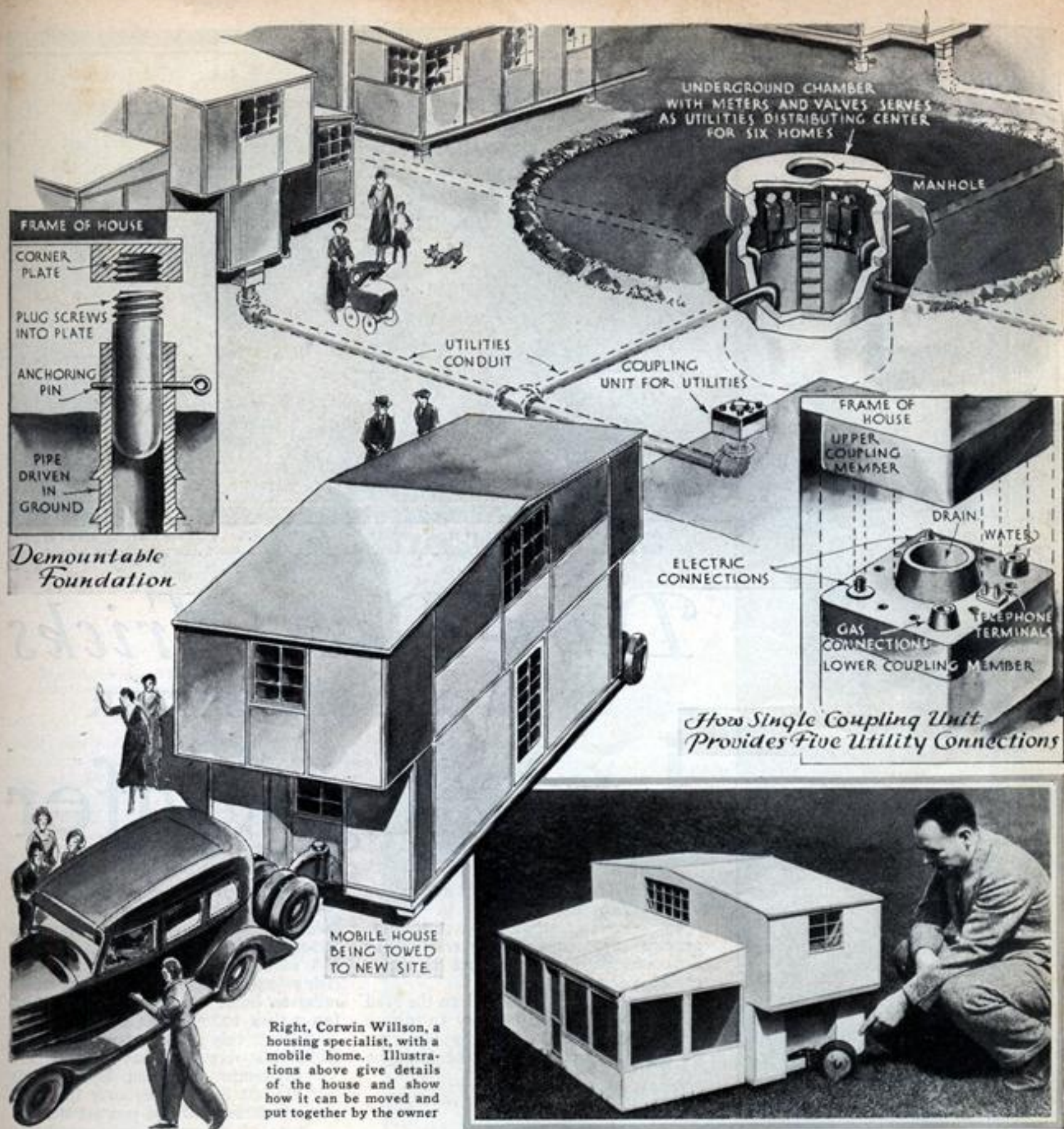


All the gold in the United States—\$3,000,000,000 in bullion—may be stored in these twin vaults. Both are identical in construction detail with the exception that the upper vault will be further protected by erection of a concrete roof which is to be two and a half feet high.

Every piece of major equipment in this upper vault is exactly like that in the lower vault, including the thirty-nine ton entrance door, the corridor down the middle and the unique automatic alarm system. The only substantial difference is that on top of this vault will be built a concrete roof two feet six inches high.

Immediately underneath the lower vault is located what is unquestionably the strangest subterranean passageway ever constructed in modern times. Made of strongest concrete, it has a ceiling only six and a half feet high. The entire section is composed of what are termed "intersecting inspection ports." These ports, spaced at intervals of about two and a half feet, are simply upraised chunks of concrete reaching to the average man's shoulder. Each one

(Continued on page 137)



House on Wheels Towed by Auto

A NEW mobile house, just invented, can be towed over the highways on detachable wheels to any site chosen by the owner. As delivered to the purchaser, the dwelling, in outside dimensions, would be smaller than many motor trucks now in use, according to Corwin Willson, housing research specialist of Flint, Mich., the inventor. The mobile unit would comprise a kitchen, bathroom, heating plant, two bed rooms and living room, and in it would be packed the unerected sectional walls, floors, and roofs of additional rooms. On the selected site, three sets of wheels

would be detached and the house set upon a demountable foundation. Erection of the sections would provide a large extra room on one side of the mobile unit and on the other a screened porch. The porch, if desired, could be enclosed and divided into two bedrooms. Gas, electric, water, and sewer lines would be attached by means of a special coupling device built into the house. Walls would be insulated against heat and cold so that the house would require less fuel than the usual dwelling of like size. Floor area would be saved by built-in furniture. Houses could

be built in this manner, the inventor estimates, for \$400. The owner, since the house would not be fixed to the land, would not have to buy a site. The inventor foresees the establishment of parking spaces on which such houses would be accommodated in groups of six. Here would be provided the necessary utility connections. For the privilege of parking the owner would pay a small ground rent. If this charge became excessive, he could hitch a car to his house and tow it to a cheaper site. This house moving would be a comparatively inexpensive process.



Planting the Stars and Stripes in the Antarctic

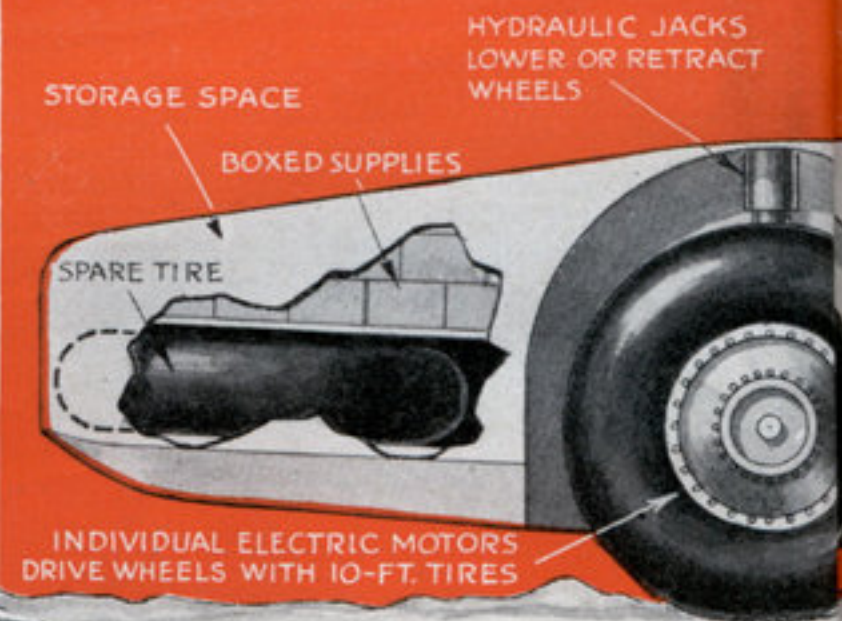
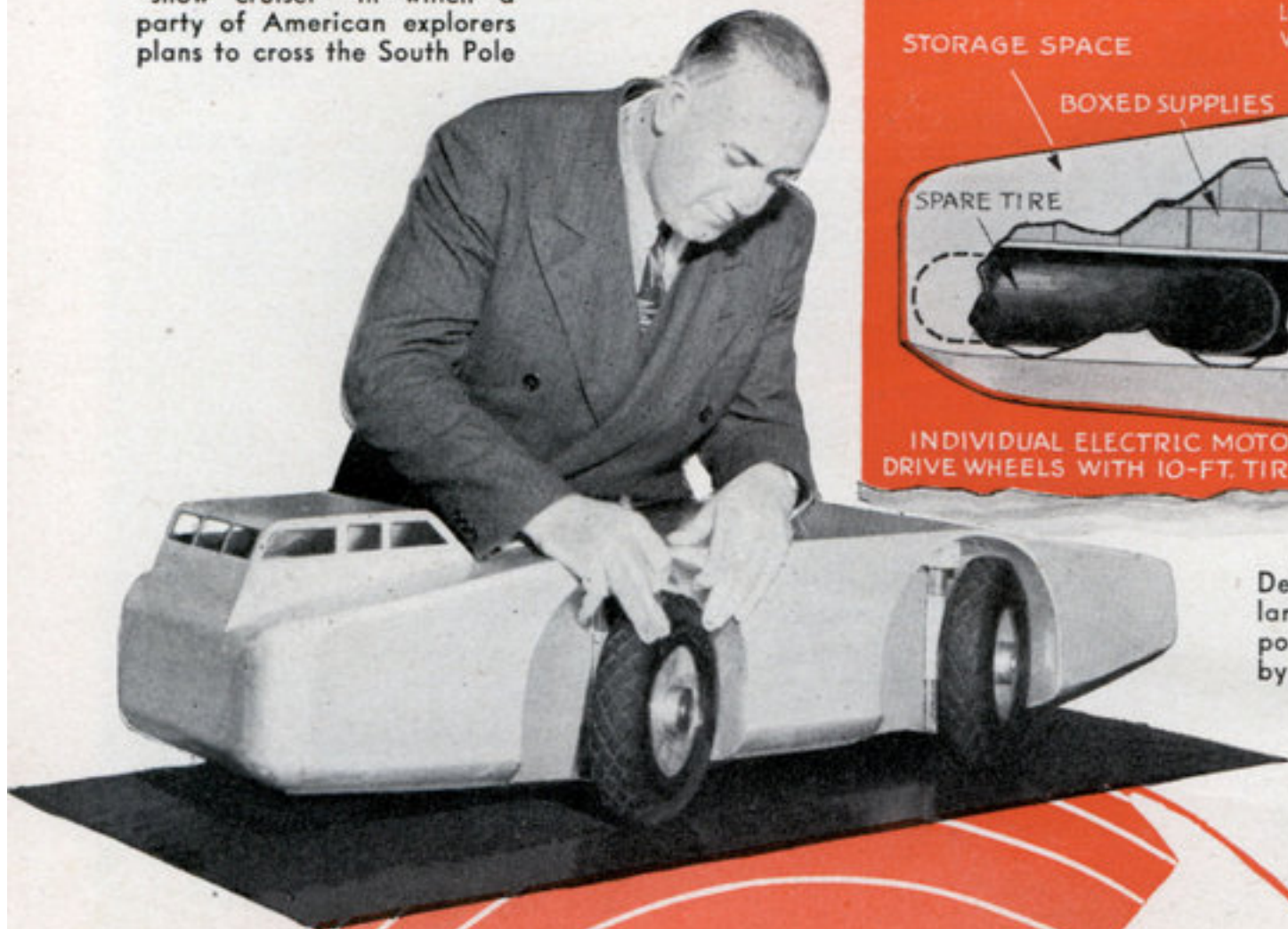
CRUNCHING snow and ice beneath ten-foot pneumatic tires, throbbing with the combined 400 horsepower of its mighty Diesel engines, a fifty-five-foot juggernaut with a swift airplane poised on its broad back soon will roll into polar lands of mystery. As fantastic a land craft as the strangest creations of fiction, this "snow cruiser" heads an array of scientific innovations that will serve the forthcoming U. S. Government expedition to Antarctica and the South Pole.

Scheduled to start early in October, the expedition marks the first official step to

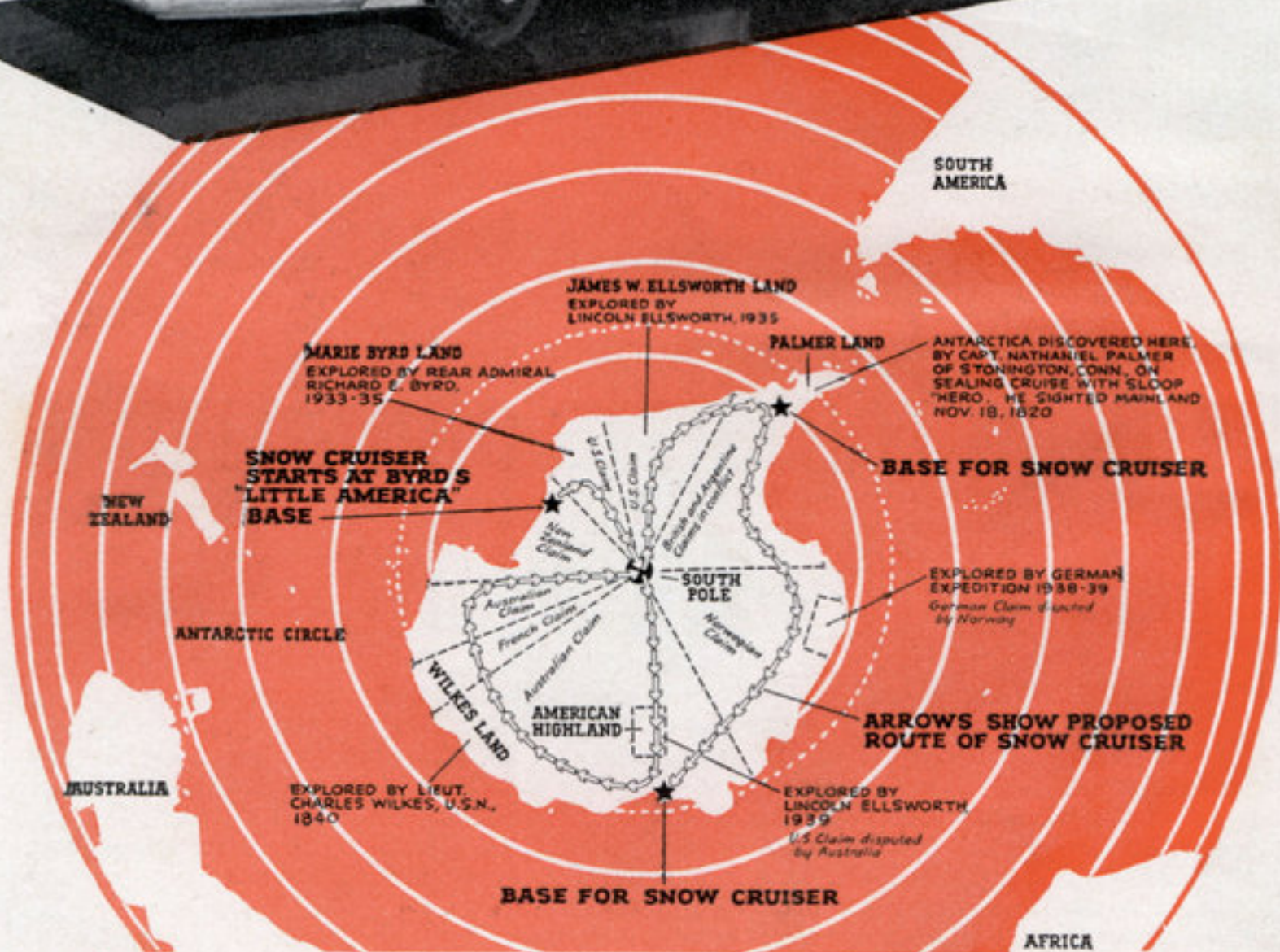
take possession, by actual occupation, of the vast sectors of the polar continent claimed for this country by Lincoln Ellsworth and Rear Admiral Richard E. Byrd. Its explorations may also strengthen long-pending U. S. claims to other areas first sighted by pioneer American explorers in the Antarctic.

Spurred by the increasing number of claimants to slices of the antarctic "pie," which now include Argentina, France, Germany, Great Britain, and Norway, Congress voted initial funds of \$340,000 for the project last June. The result is a newly created

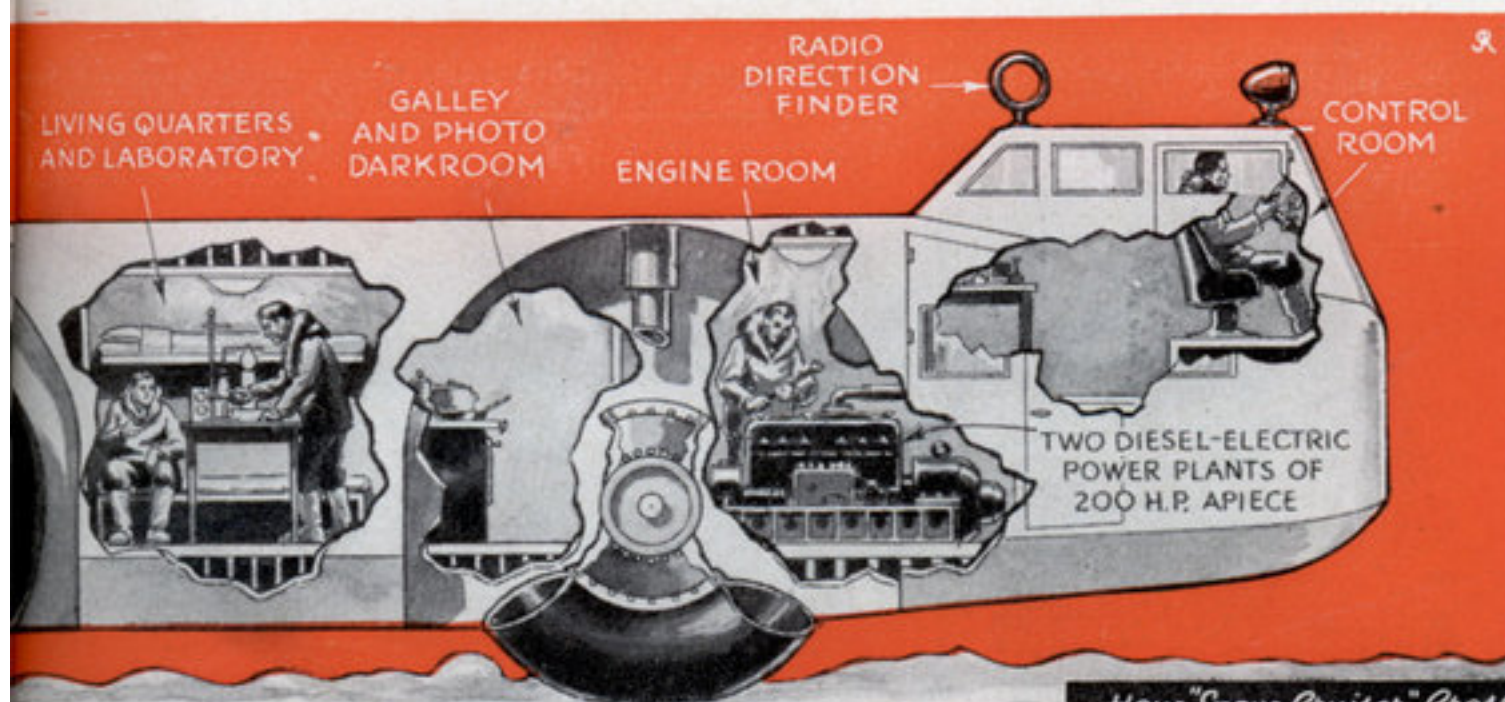
This is a model of the huge "snow cruiser" in which a party of American explorers plans to cross the South Pole



Details of the queer land craft. Its proposed route is shown by arrows on the map



AMAZING "SNOW CRUISER" TO CARRY POLAR PIONEERS TO STAKE OUR CLAIMS AT THE BOTTOM OF THE WORLD

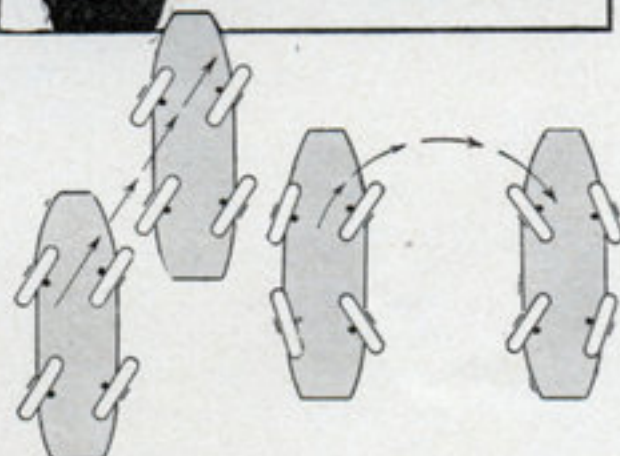
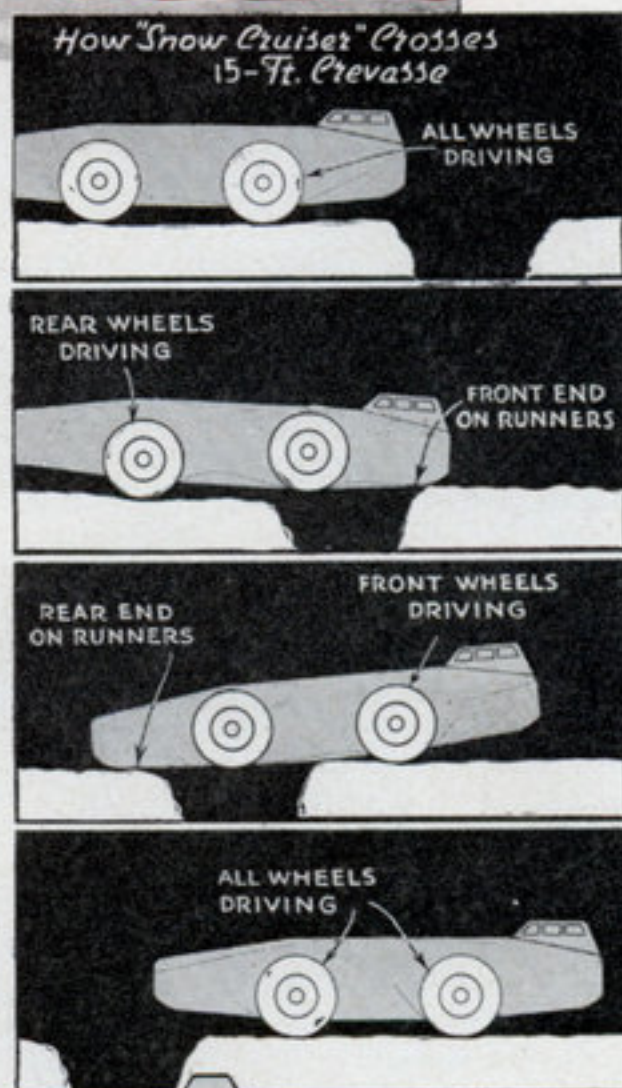


Government bureau, the U. S. Antarctic Service, with Admiral Byrd as its head. Leading a party of 160 men, he will establish three semipermanent bases in antarctic wastes now inhabited only by penguins and seals. Each year new "colonists" will be sent to relieve their predecessors, on the principle that continued occupancy affords the best claim to new land. Formal annexation of American zones in Antarctica may come at a later date—perhaps after an international commission has settled conflicting claims, and fixed boundary lines, by joint agreement or arbitration. The territory to which our claims are undisputed, alone, would add an area vaster than Alaska to U. S. domains.

Why do we want this frigid land? Not only to protect our whaling interests, and to establish weather observatories that would prove an invaluable aid to long-range forecasting. Coal resources second only to those of the United States, together with oil, copper, nickel, and tin, await those who develop Antarctica. Air bases, both commercial and naval, may be established one of these days on the polar continent. Only about 575 nautical miles, a few hours' flight for either a clipper plane or a bomber, separate the tip of South America from Palmer Land in the Antarctic. That lends point to our objective of extending the Monroe Doctrine, and forestalling the encroachment of foreign powers in the Western Hemisphere, clear to the pole.

Lessons learned by past expeditions will aid the present one. One hazard formerly faced by polar pilots, returning to their bases, was sudden snow or fog that cut visibility almost to zero. This time they will follow the beam of a miniature radio transmitter back to the base camp, like a commercial airliner making port.

Sledge dogs drugged with opiates, each in its aluminum crate, will be flown to points far inland. Noise and strangeness of airplane flight drove the high-strung animals insane with fear, when a previous expedition tried transporting them by air. Humane use of "knock-out drops" will now permit



AS FANTASTIC AS A PRODUCT OF JULES VERNE'S BRAIN

As illustrated above, wide crevasses in the ice will hold no terrors for this polar juggernaut. Special steering arrangements make many maneuvers possible

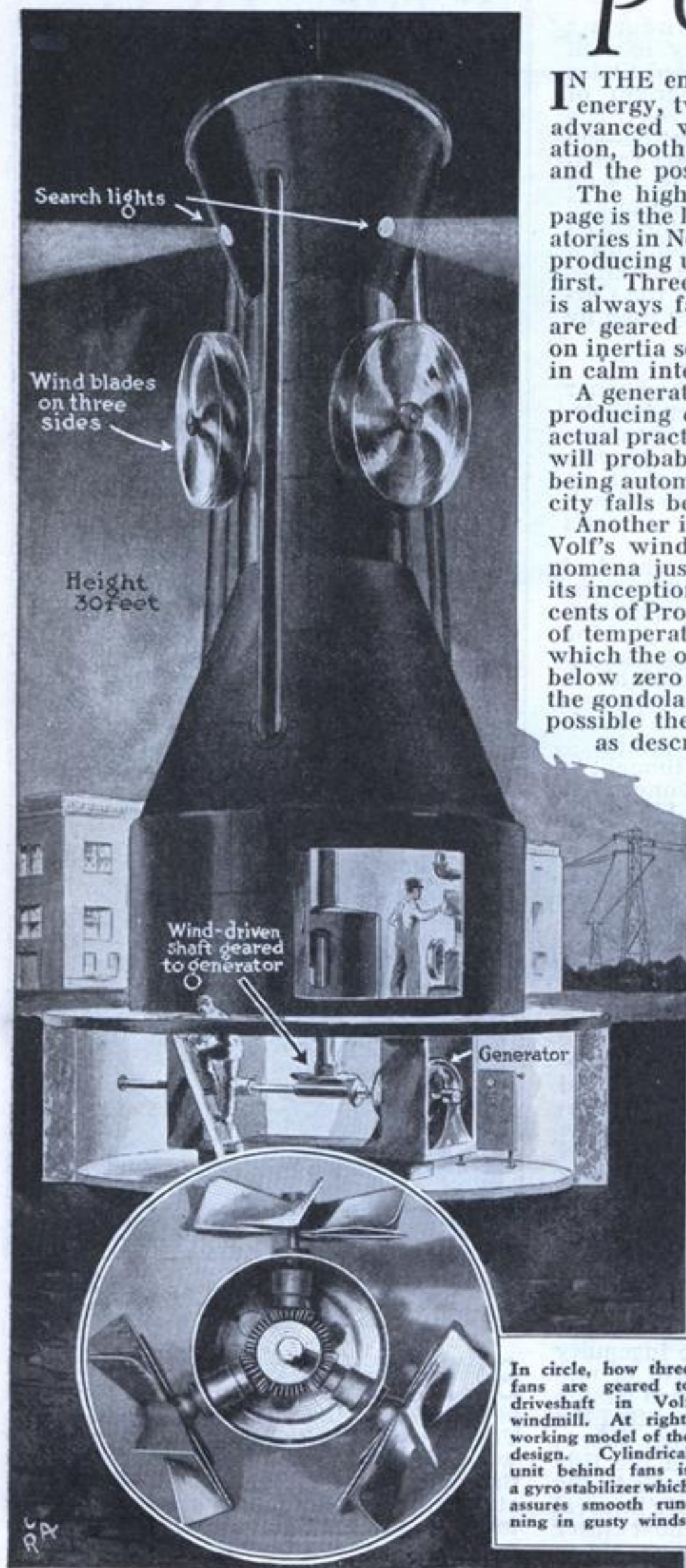
PULLING

IN THE endless quest for cheap sources of energy, two proposals have recently been advanced which demand serious consideration, both for appeal to the imagination and the possibilities of practical operation.

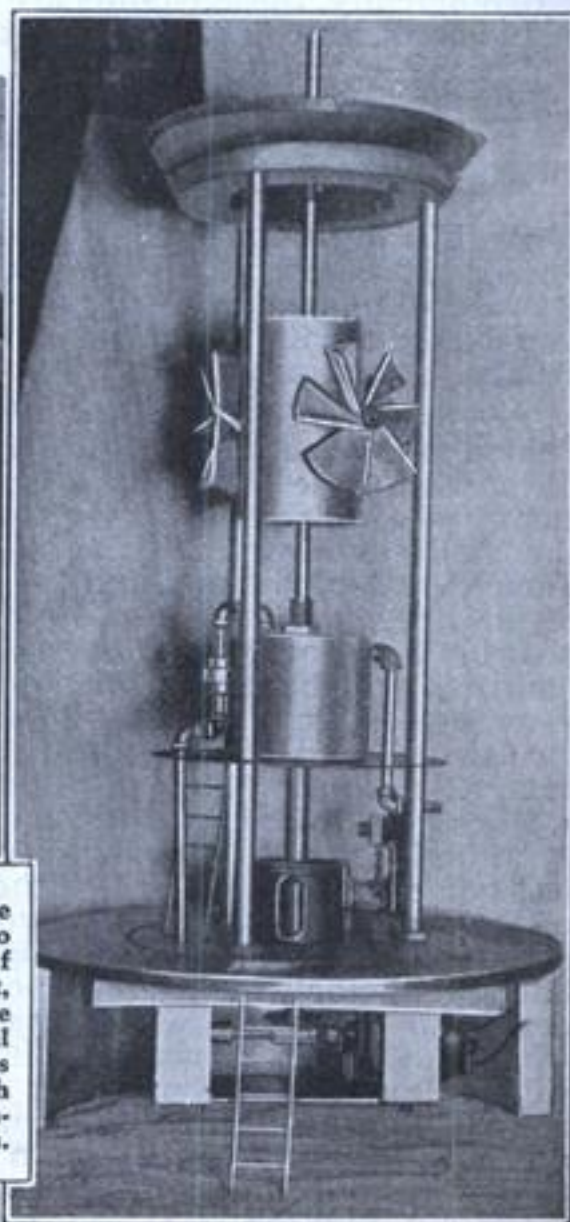
The high speed windmill shown on this page is the latest development of Volf's laboratories in New York. The first of these power producing units will be in operation by May first. Three fans are provided so that one is always facing a wind current. The fans are geared to a gyro stabilizer which runs on inertia so that the fans will not run down in calm intervals between gusts of wind.

A generator is driven by the geared shaft, producing current for storage batteries. In actual practice three or four small generators will probably be used, one or more of them being automatically cut out when wind velocity falls below a certain point.

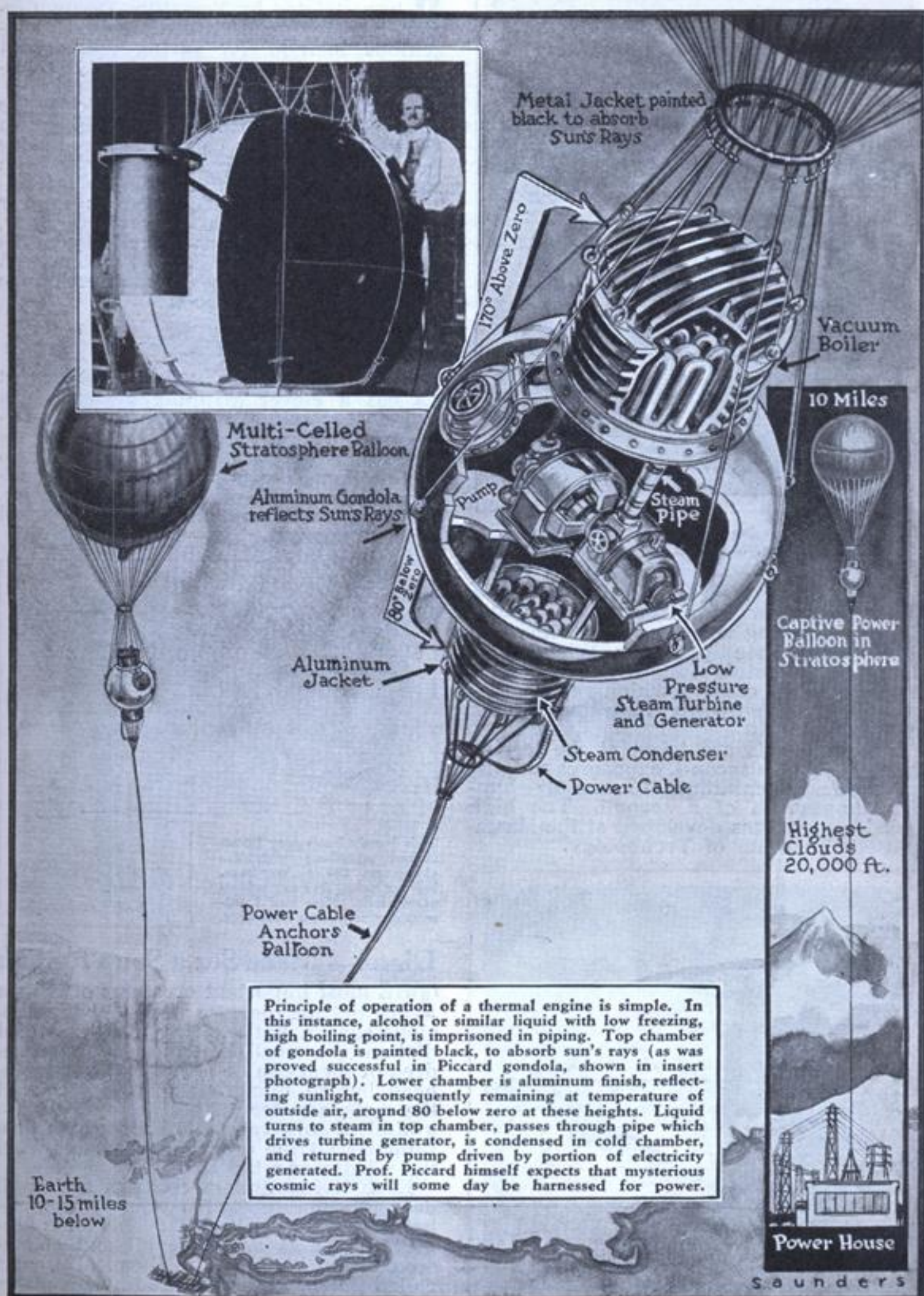
Another idea, less close to realization than Volf's windmill but involving natural phenomena just as dependable, partially owes its inception to the stratosphere balloon ascents of Prof. Auguste Piccard. The extremes of temperature encountered by Piccard, in which the outside air was around 75 degrees below zero while interior temperatures of the gondola were around 100 degrees, makes possible the operation of a thermal engine as described in detail on opposite page.



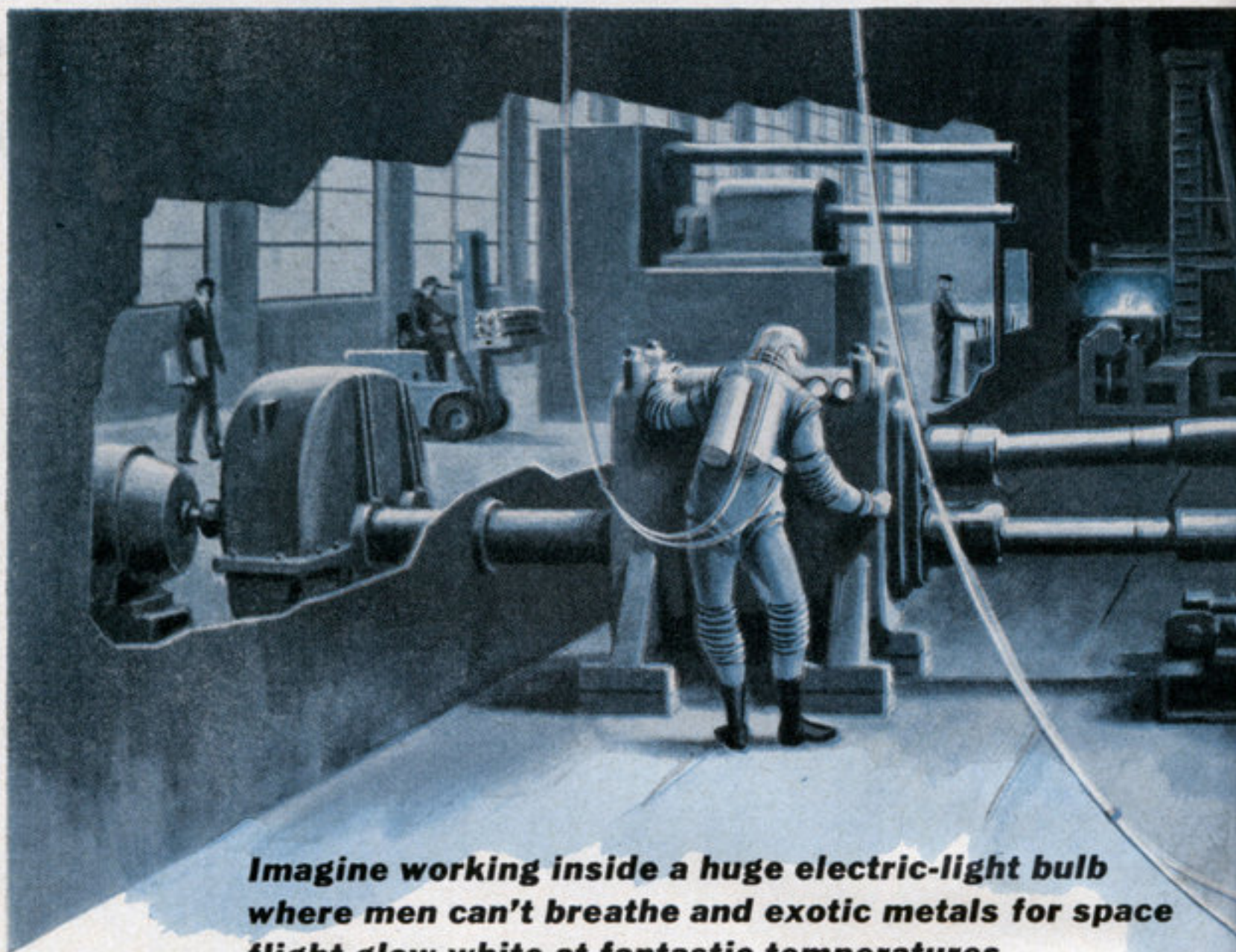
In circle, how three fans are geared to driveshaft in Volf windmill. At right, working model of the design. Cylindrical unit behind fans is a gyro stabilizer which assures smooth running in gusty winds.



POWER from the SKIES



This thermal power plant, anchored by captive balloon high above the clouds to operate through heat of sun and cold of atmosphere, is an idea based on sound physical laws, demonstrated in Piccard balloon ascent a year ago.



Imagine working inside a huge electric-light bulb where men can't breathe and exotic metals for space flight glow white at fantastic temperatures

Workers Wear Space Suits in New Gas-Filled Factory

EXOTIC metals that can survive the heat barrier of hypersonic flight soon will be mill-worked at a white-hot 4,000 degrees in a forbidding atmosphere of argon gas, similar to that inside an incandescent light bulb.

Men working in this out-of-the-world gas-chamber metal mill will wear "space suits," trailing umbilical cords plugged into air-breathing and exhaust manifolds.

Should a lifeline break, a man might live a minute or two—as helpless as if he were out in space or under water without an oxygen supply. Crash doors will provide a quick escape. But in case he

is injured or some obstacle gets in the way, he will have an emergency air capsule to keep him alive until rescue comes.

"Fire cannot burn in it." Argon, a rare element in air, is a by-product of plants that extract oxygen and nitrogen from air. It is an inert gas, which means that it does not react with other materials. Fire cannot burn in it, because there is no oxygen. In an incandescent light bulb, it protects the delicate filament from burning out.

In the new In-Fab (inert-fabrication) plant, argon will be used for much the same purpose. Metals known as "refrac-



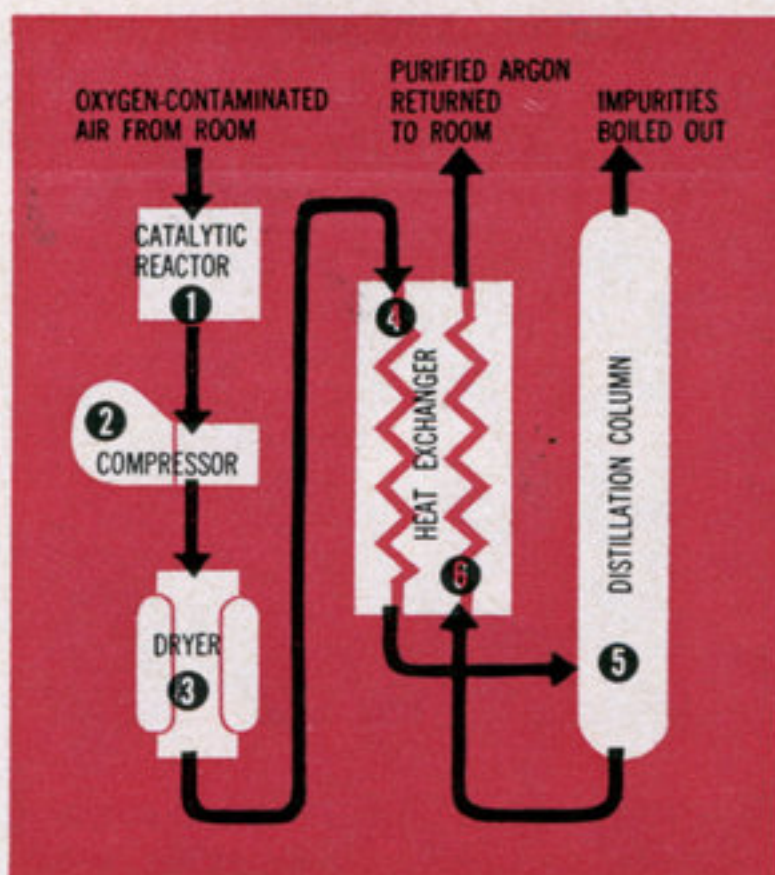
PLANT WITHIN A PLANT: Artist's conception of the Navy's inert fabrication mill being built by Universal-Cyclops Steel Corp., inside a building at Bridgeville, Pa.

tories," which maintain their strength at extreme temperatures, do not get along with two enemies contained in air—oxygen and nitrogen—when raised to the heat at which they are best worked.

One of the most promising of these refractory metals at present is molybdenum.

To achieve maximum strength it should be fabricated at 80 percent of its 4,752-degree melting point. At that heat, oxygen attacks the metal with a violence that not only causes internal damage, but raises great clouds of obscuring smoke.

To prevent this, the argon atmosphere



HOW CONTAMINATED ARGON GAS IS PURIFIED: (1) oxygen becomes water; (2) gas heated; (3) water removed; (4) gas cooled; (5) other impurities removed; (6) pure argon reheated.

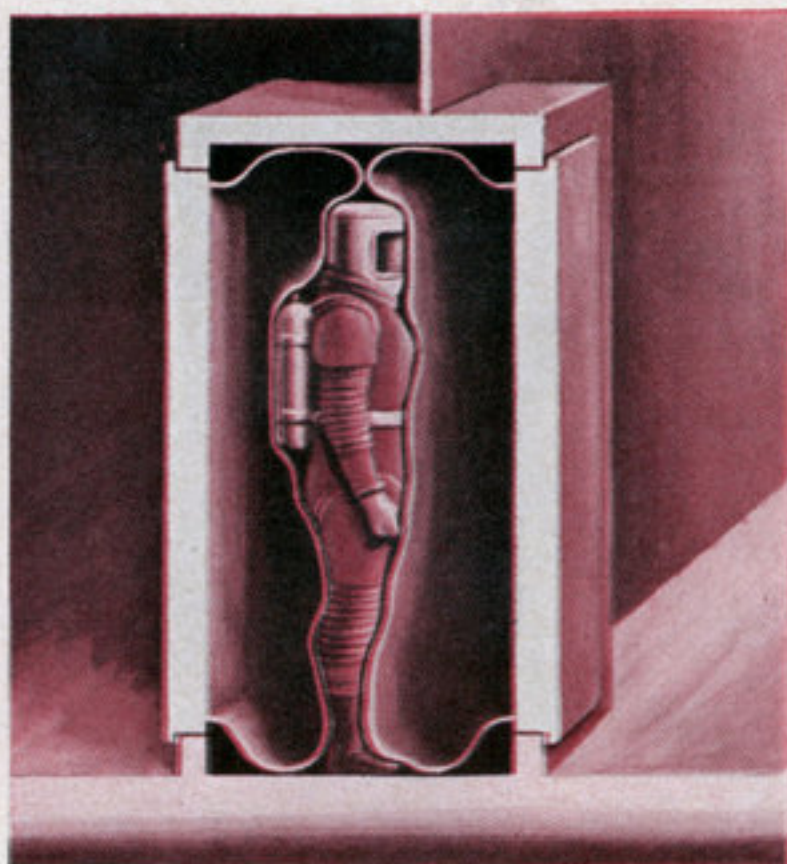
in the \$3,000,000 pilot plant will be kept so oxygen-free that if the glass of a light bulb were broken, the filament would continue to glow. To accomplish this, the chamber, 40 feet by 80 feet, and 25 feet high, will be as airtight as welded steel plate can make it.

Leakage is "out." Also, the argon will be at a slightly higher pressure than the outside air, so that what little leakage there is will be argon *out*, rather than air *in*. But despite precautions, there will be some leakage, such as from the suit itself, with an air-breathing man inside.

An argon recirculating and purifying system will take care of that. It will renew the atmosphere every three hours, cleansing the gas, keeping oxygen and nitrogen content down to less than 50 parts in a million.

When the chamber is filled, argon will not be pumped in directly, since it is expensive, and some would be lost in mixing with air. Instead, the recirculating system will be used to force nitrogen in through ceiling diffusers, and withdraw air through floor registers. Then argon will be pumped in, replacing the nitrogen in the same way.

Cooling will be a problem, since glowing metal would soon send temperatures soaring to furnace heat. Even with the argon passing over a cooling unit, it will



DOUBLE-DOOR PERSONNEL LOCK is lined with plastic diaphragms that hug the contour of a space-suited man, excluding most of the air before he opens the door into the gas chamber.

be hot, as high as 110 degrees. So the space suits will have built-in air conditioning. And they will have insulation to protect men working close to white-hot metal.

The men will be there mostly to observe, and to handle minor chores not suitable to automation. Outside, at "pulpits," operators using remote controls will work the heavy machines: an impactor that will hammer hot ingots into billets and sheet bar; a rolling mill to convert these into rounds and sheet. Each will have its own electric induction furnace for heating the metals. An open-hearth furnace would be impossible, since argon gas will not support combustion.

Other metals later. The In-Fab plant was designed for molybdenum. It will, however, be adaptable for practical hot-working of other refractory metals, such as tungsten, rhenium, tantalum and columbium, at temperatures that have so far been impossible outside the laboratory and experimental setups.

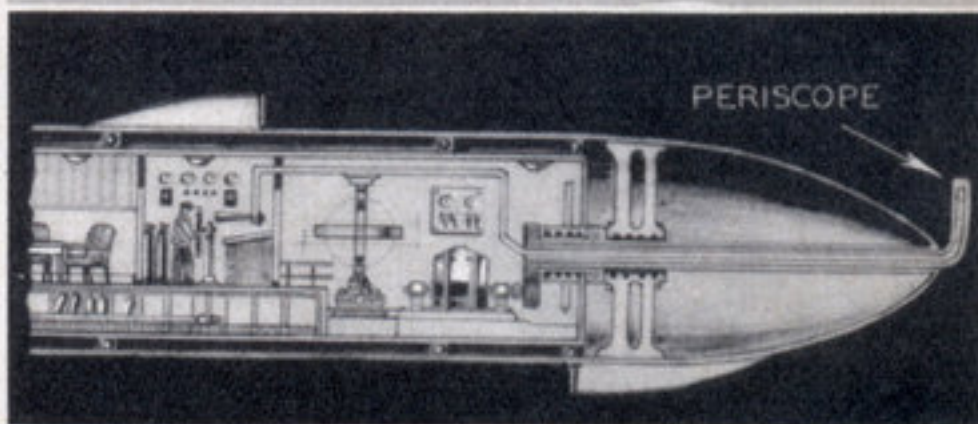
From these tough metals will come the heat-critical parts for faster jets and hotter rockets, and for the nose cones and leading edges of missiles and space craft that, re-entering the earth's dense atmosphere, will be subjected to temperatures that would melt or vaporize ordinary metals.—Herbert O. Johansen.



Tomorrow's Inventions

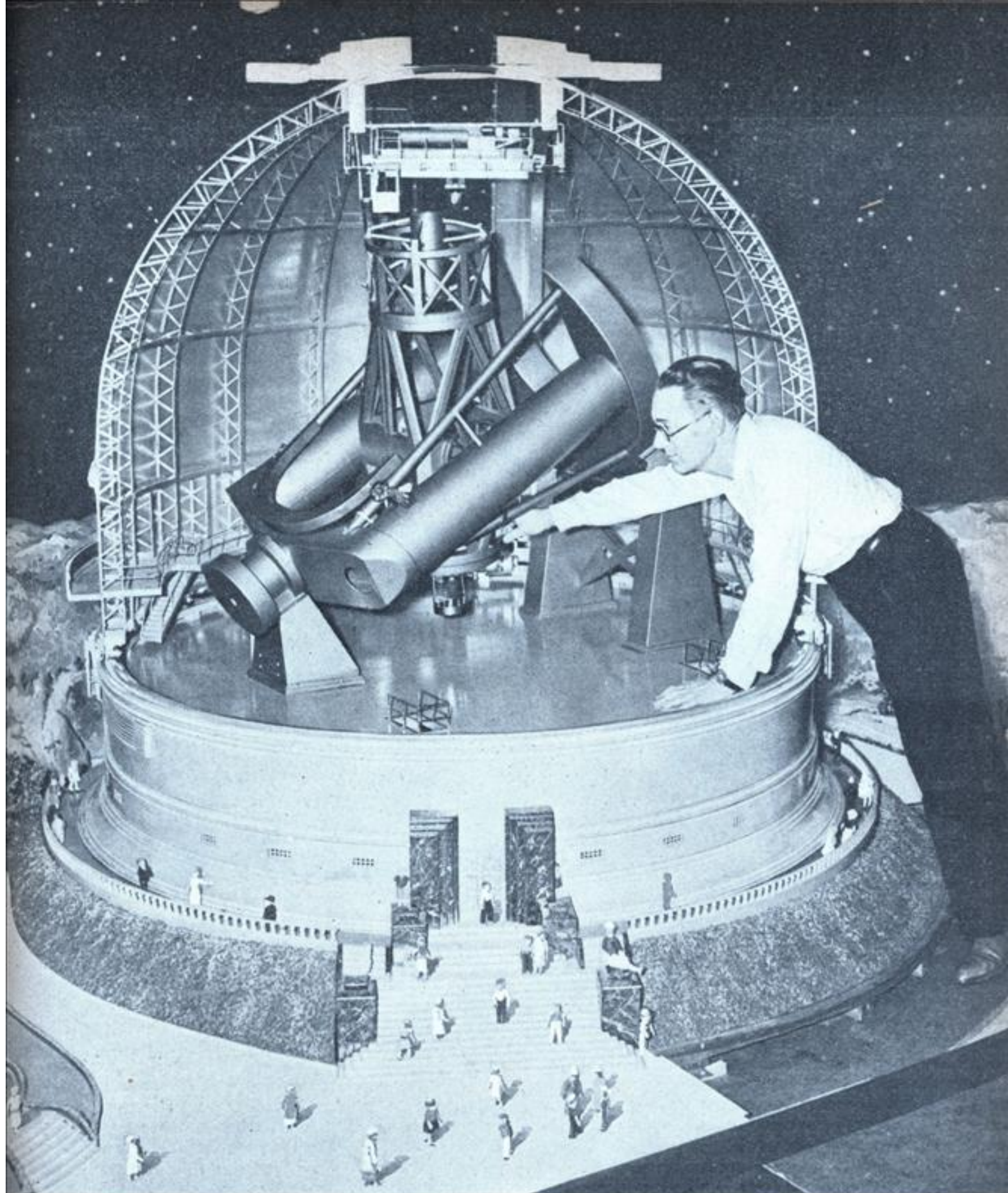
PLANs for a speedy submarine "screw-ship," which would serve as a carrier for the quick dispatch of mail and freight between continents, have been developed by Maximilian Bernd, an engineer in Hamburg, Germany. Resembling a torpedo in general appearance, the proposed underwater craft consists of two parts. One, a cylinder-like inner chamber, features the crew's rooms, the storage hold, engines (electric) and a gyro device to maintain balance. The other part of the future "screw-ship" consists of a steel outer jacket which rotates around the stationary inner chamber by means of a special gear and bearing arrangement and which has spiral-shaped metal fins fastened to its surface. When the engines cause the outer jacket to rotate, the spiral fins screw into the water much as the threads of a screw bite into wood, thus forcing the craft forward. A periscope at the nose and a rudder at the rear facilitate steering.

Above—A look into the future! The first submarine "screw-ship" arriving with mail and express after crossing the ocean in less than one day.



Above—Cross-section of proposed "screw-ship" showing inner stationary chamber, which houses machinery, crew, gyro, etc., and the outer jacket which revolves around inner chamber, providing propulsion by means of spiral fins, as sketched below. Gyro keeps inner chamber level during trip.



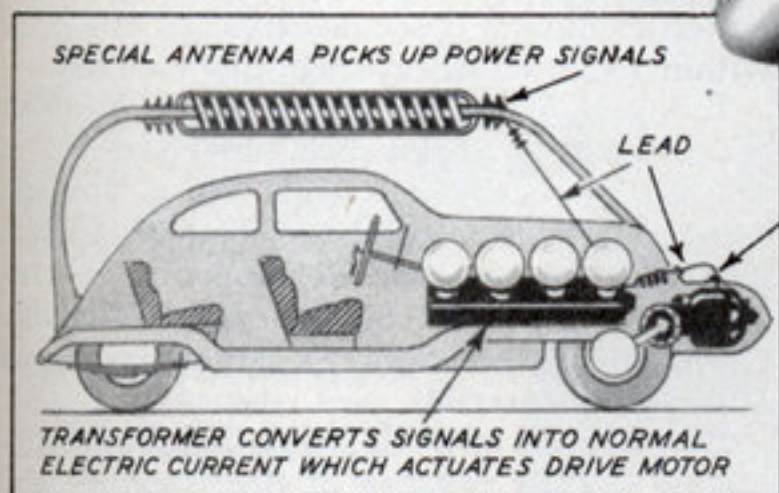
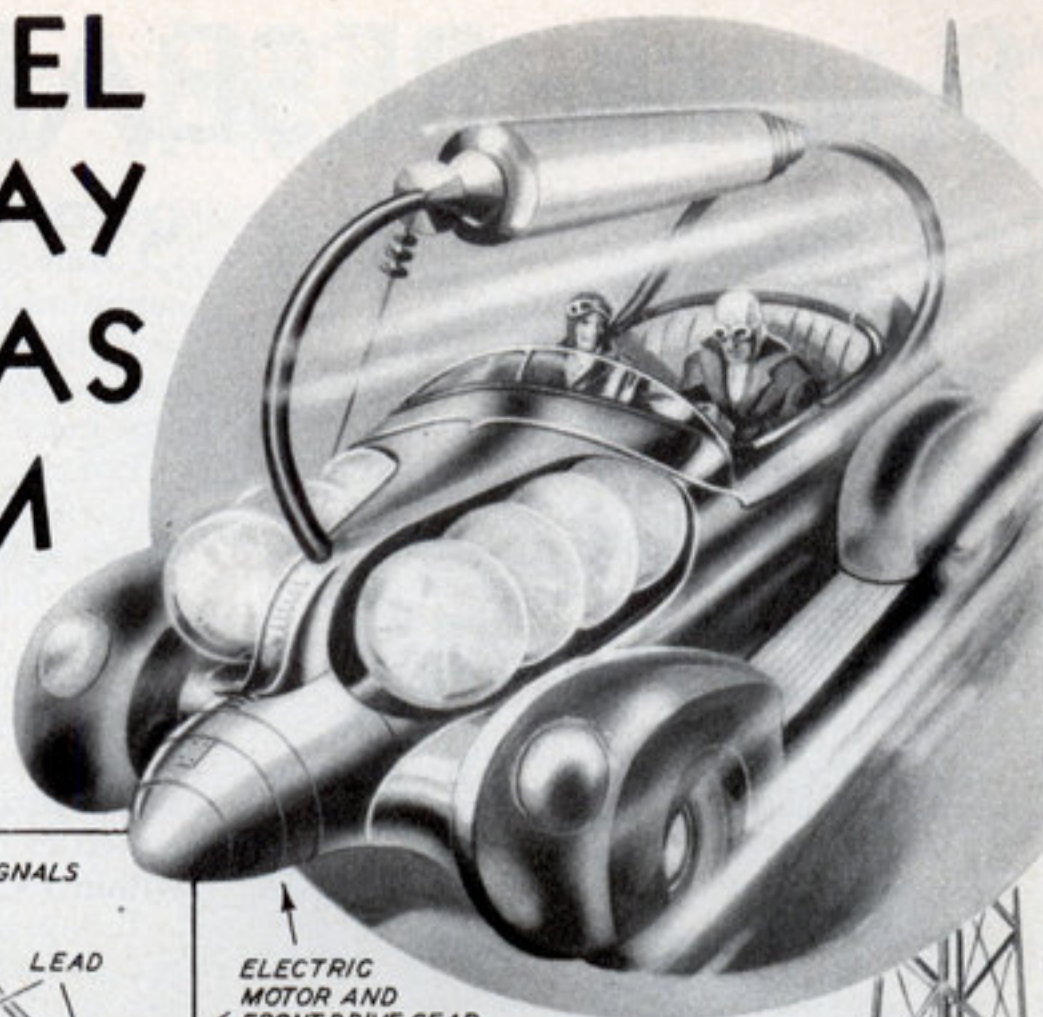


Model Shows 200-Inch Telescope

MOUNT PALOMAR Observatory in California, and its 200-inch telescope, largest in the world, which will be placed in service in 1939, are depicted in miniature in a remarkable scale model constructed by

Samuel Orkin, above, in collaboration with the California Institute of Technology. One twenty-fourth the size of the \$15,000,000 observatory's fourteen-story-high dome, the model will be exhibited on a world tour.

RADIO-FUEL AUTOS MAY SOLVE GAS PROBLEM



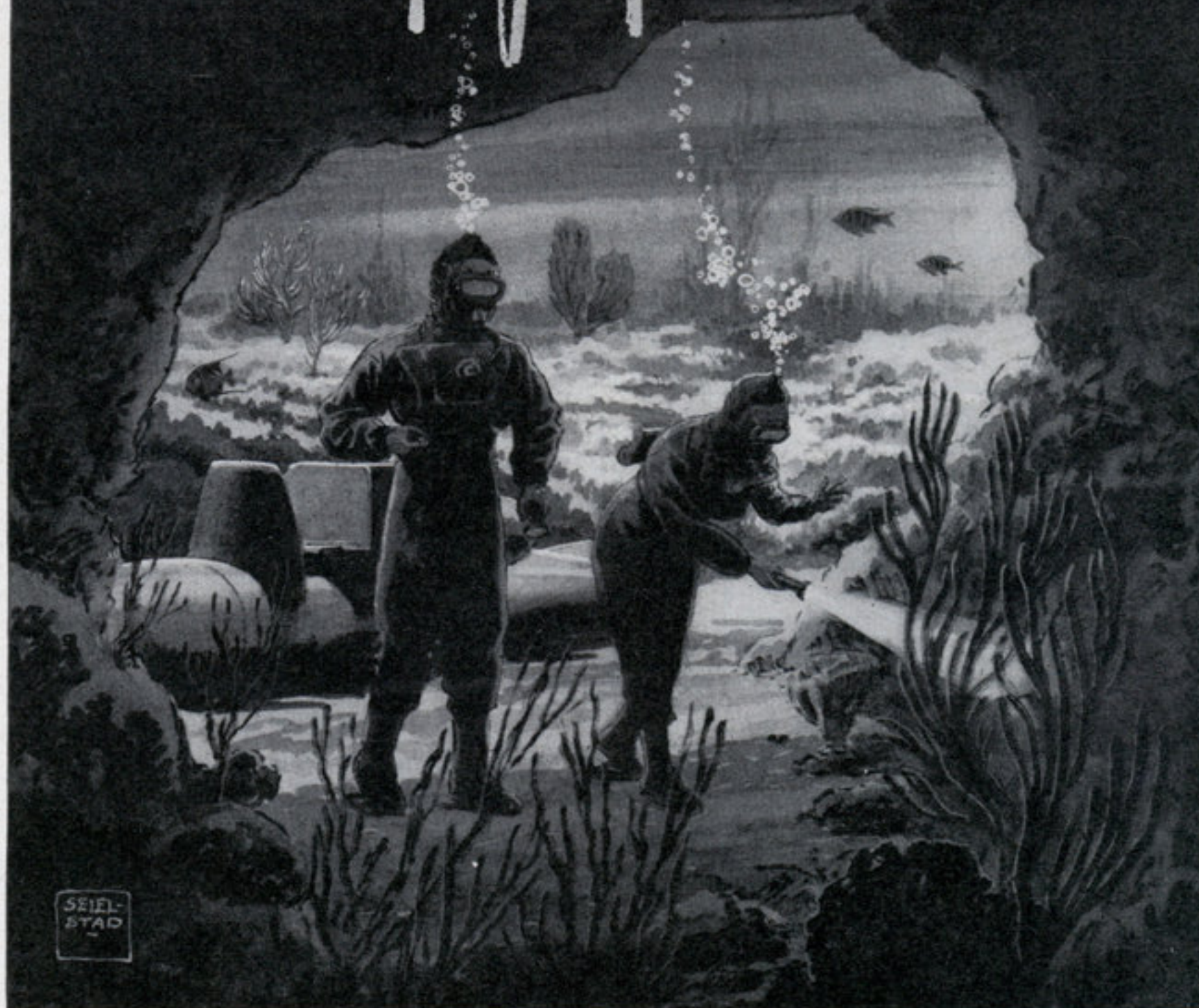
ELECTRIC
MOTOR AND
FRONT DRIVE GEAR

Above—Artist's conception of the radio power car of the future. The huge tubes form part of the converter receiver device. Left—Principal units in the car. Unusual silence and flowing power would be a marked feature. Below—A typical broadcast tower station. Electricity converted into signals would be constantly broadcast from stations of this nature.

AUTOS operated on radio fuel may become a reality if the present consumption of oil continues and no new oil sources are discovered. One engineer boldly suggests a network of "radio highways" consisting of huge broadcast transmitters capable of sending out signals which would be converted into motive power. Provided with special radio energy converters automobiles would be silently operated by powerful electric motors. By simply throwing a switch on the dash the motors would be put into motion, eliminating starters, noise and dangerous carbon monoxide gas. Fortunately, science has delved into the fuel problem and found a solution for a matter which has for years been on the verge of confronting automotive engineers.



"Come with Me on My Jeepmarine"



Submarine holidays are made possible by a peacetime adaptation of the British "torpedo built for two."

By **WALTER NUNN O'BONDIE**

Lieutenant, R.N.V.R.

EVERYBODY seems to be thinking of flying for fun after the war. Many Americans apparently hope to swap their flivvers for helicopters and spend their spare time dangling from the sky, munching hot dogs

bought at a convenient blimp filling station.

But not for me! My wife and I are going to spend our week ends touring the bottom of the sea on our jeepmarine. We plan to explore caves and grottoes on the ocean floor. We'll park our tandem underwater motorbike on the barnacled deck of some ancient wreck, and search for doubloons and

pieces of eight. When time permits, we'll ship our jeepmarine to tropic seas and go riding through coral groves, dismounting occasionally to look for pearls. At least, we'll be sure to return with a handsome bath sponge of our own plucking.

Such fancies are a diversion from the grim, dirty job of waging war. But my dream has substance; it is far more realizable than the hope of the demobilized pilot to go flitting through the clouds with his ladylove. The initial cost and upkeep of my "submarine built for two" will be much less than that of a flying machine. It will be less dangerous to operate, and I won't be bothered so much by rules and regulations.

Little serious thought has been given to the peacetime possibilities, for sport and industrial use, of the "human-torpedo" craft designed to attack enemy ships and harbor installations. But I know of two men now assigned to one of these new naval weapons—one is a hairdresser in civil life and the other a dry cleaner—who hope to buy a decommissioned jeepmarine from the government after the war and use it to explore the Spanish Main for galleon gold.

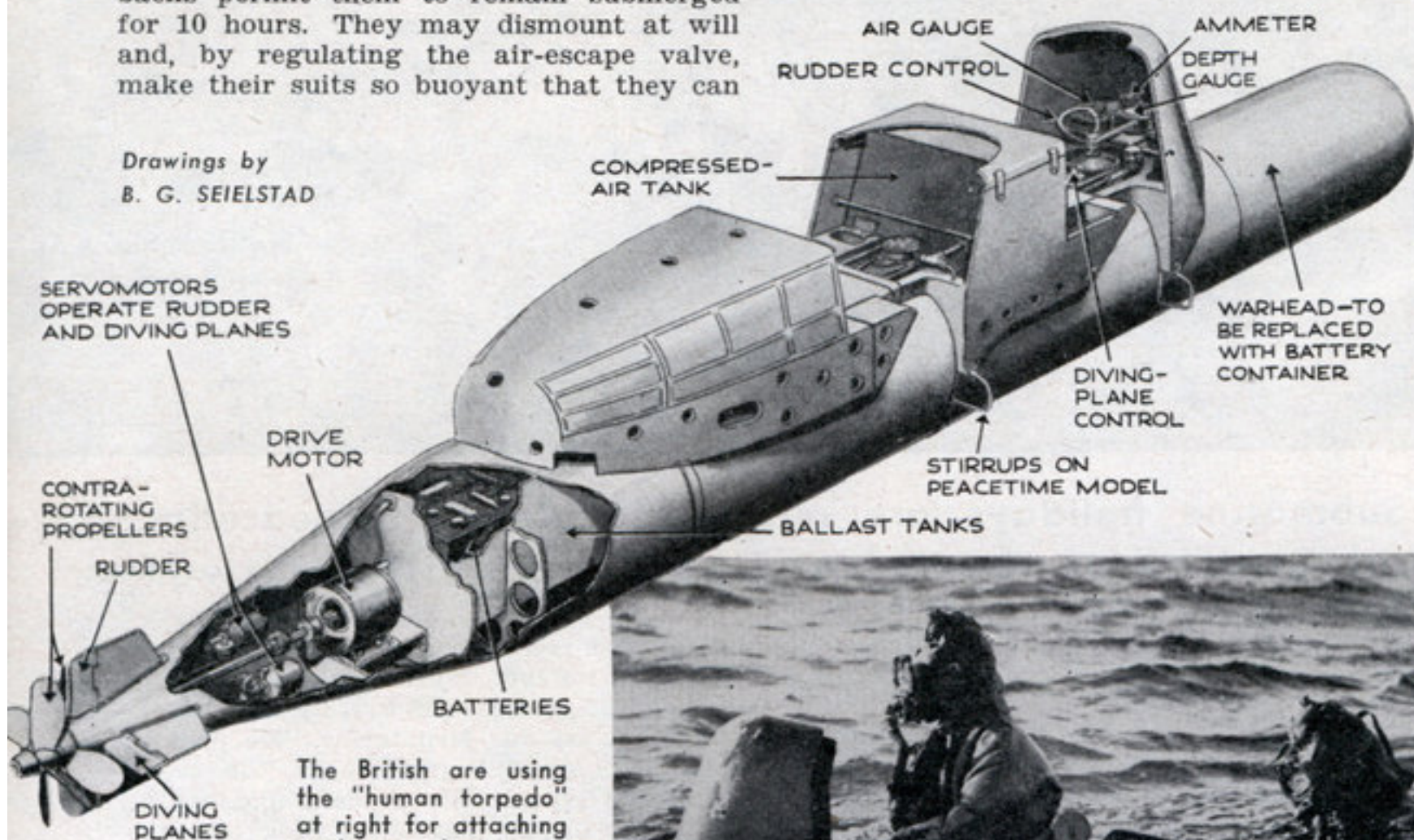
The submarine motorbike has a cylindrical chassis 21 feet long. Two persons sit astride it behind conventional-looking motorcycle windscreens. They wear diving suits that weigh less than 50 pounds, and their hands are left bare. Each person can dress himself for undersea cycling in less than five minutes. Oxygen flasks carried on their backs permit them to remain submerged for 10 hours. They may dismount at will and, by regulating the air-escape valve, make their suits so buoyant that they can

float like fish at any level. Deflating their suits permits them to walk, with their lead-soled boots keeping them vertical.

The jeepmarine is powered by storage batteries. It can cruise on the surface or dive to any bearable depth, then level off and proceed in any direction. Contra-rotating propellers nullify torque; one propeller is mounted on a hollow shaft revolving around the solid shaft of the other, both driven through a simple gear box. The craft is steered by means of vertical rudders, the same as any small boat; it dives and ascends by use of port and starboard hydroplanes or fins. Movement in all four directions—up, down, left, or right—is controlled with a single steering apparatus similar to the stick of an airplane. The present submerged speed is only a little faster than a brisk walk, and the cruising range is about 10 miles. The range could be increased by adding more storage batteries in place of the explosives that the "human torpedo" is built to carry.

Candidates for wartime jeepmarining assignments must pass rigid physical and psychological examinations. But when the hazards of war are removed, any able-bodied person should be capable of operating one of these submarine motorbikes. You will not even be disturbed by your wife's comments from the rear seat; there is no means of oral communication between persons in separate diving suits.

Drawings by
B. G. SEIELSTAD



The British are using the "human torpedo" at right for attaching explosive charges to the hulls of enemy vessels. The author of this article foresees a post-war role for it as an undersea pleasure car

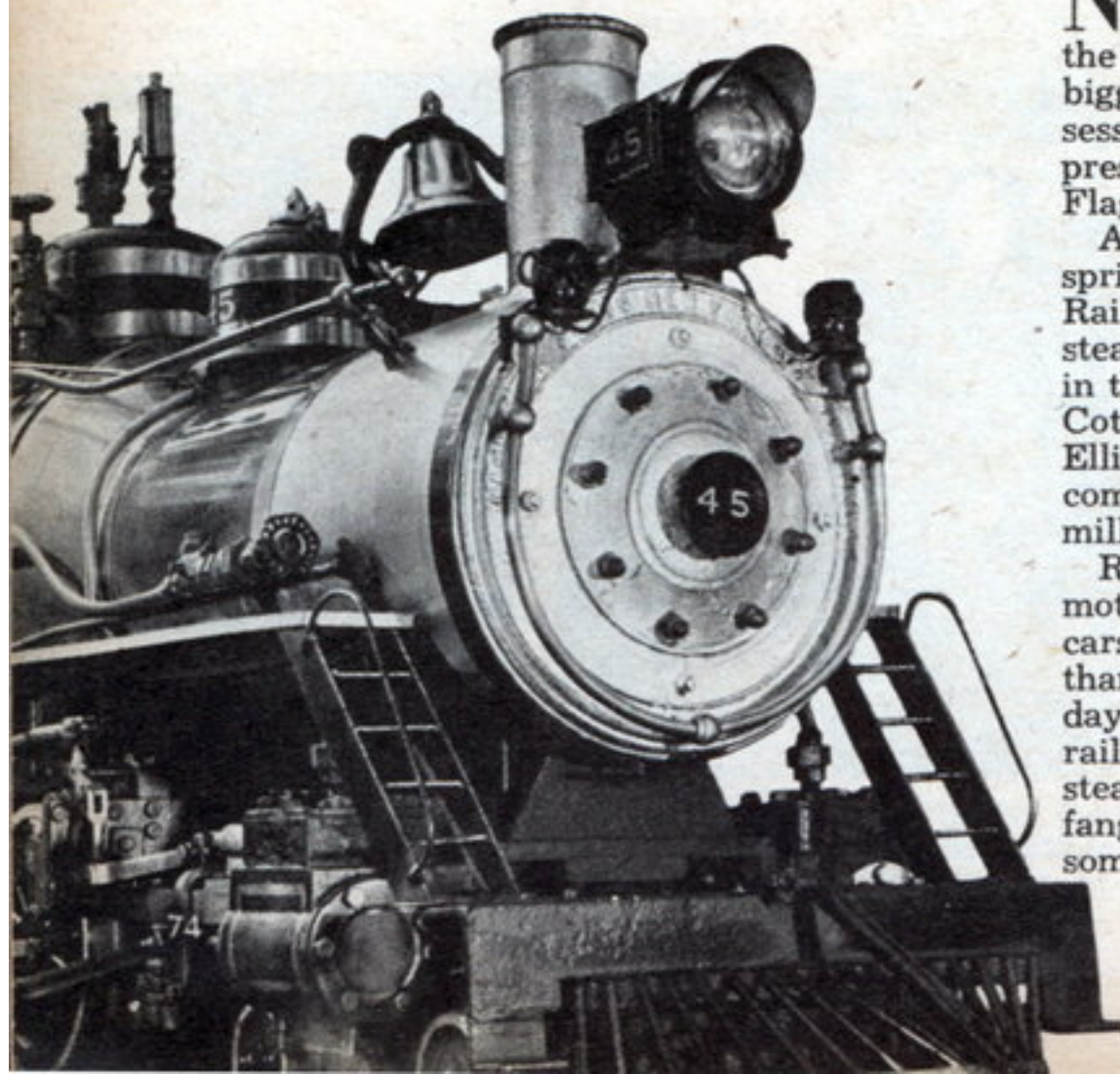


COVER STORY



Springmaid engineer waits for Engine 45 to get steamed up before starting on the one-mile park run.

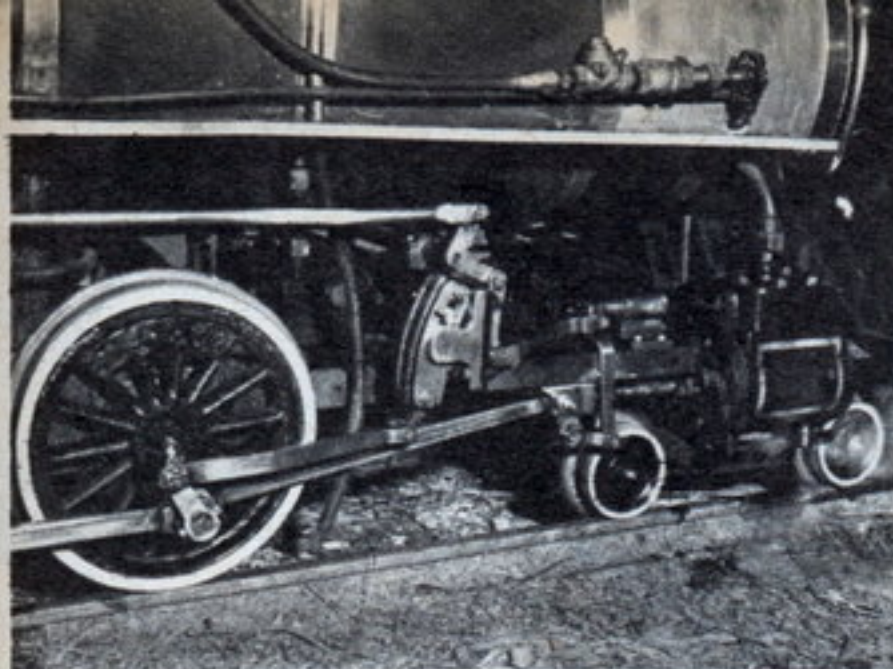
BIGGEST BABY RAILROAD



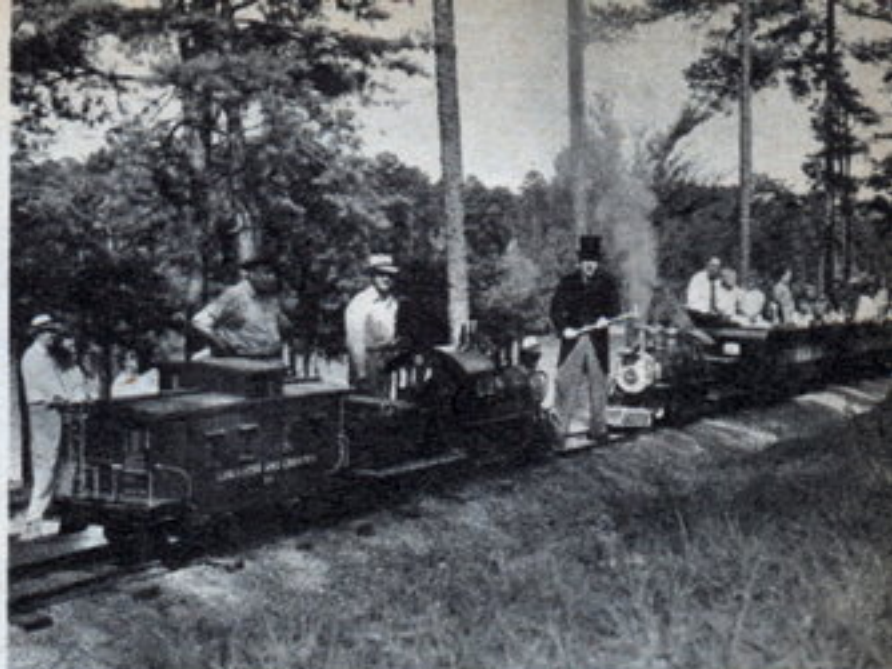
NEAR Lancaster, S. C., you can find the biggest baby railroad in the country. Well, maybe not the biggest in size, but certainly possessor of the biggest list of vice-presidents—from James Montgomery Flagg to Gypsy Rose Lee.

Actually, though, this tiny offspring of the Lancaster and Chester Railway is one of the finest miniature steam railroads in the world. Located in the recreation park of the Springs Cotton Mills, it's the brainchild of Elliott White Springs, World War I combat flier, author, owner of the mill and president of the L & C.

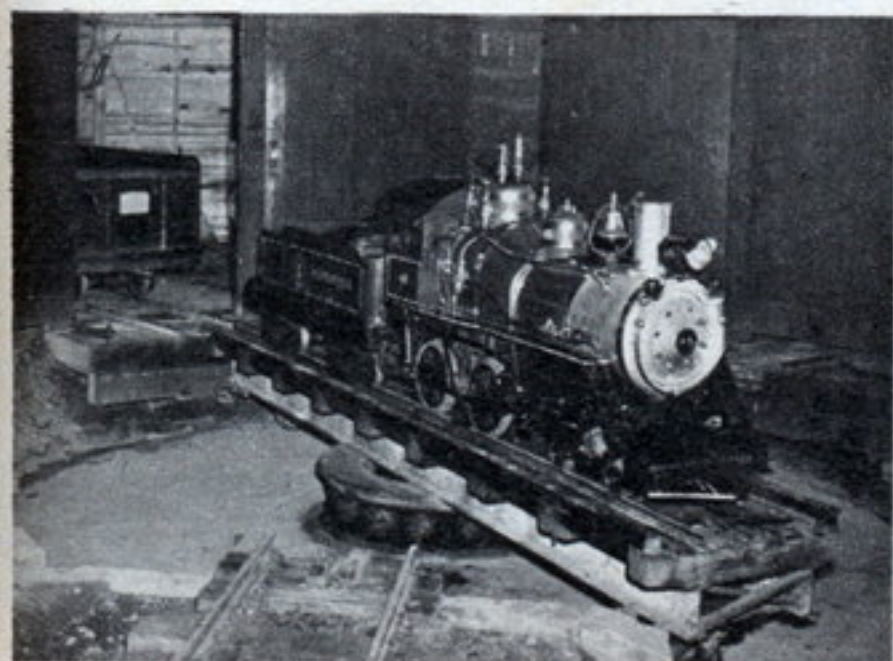
Rolling stock consists of three locomotives, four passenger cars, two flat cars and a caboose. There's more than a mile of track. On their off days, you can usually find oldtime railroaders at the controls of the little steamers. What with those new-fangled Diesels, they get sort of lonesome for the huffing and puffing. •



Under the engine's boiler is all the strength of a crack express. Details are so faithfully reproduced they're hard to tell from real thing.



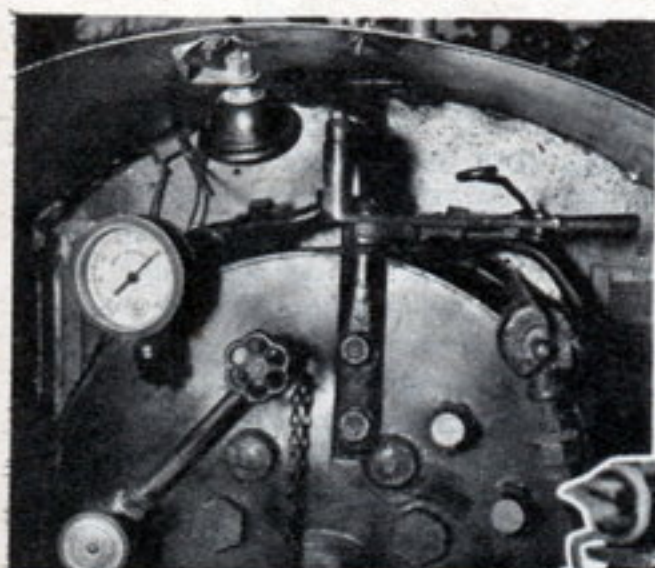
President of the Lancaster and Chester Railway drives a golden spike into the tracks to link the east and west coasts of the recreation-park railroad.



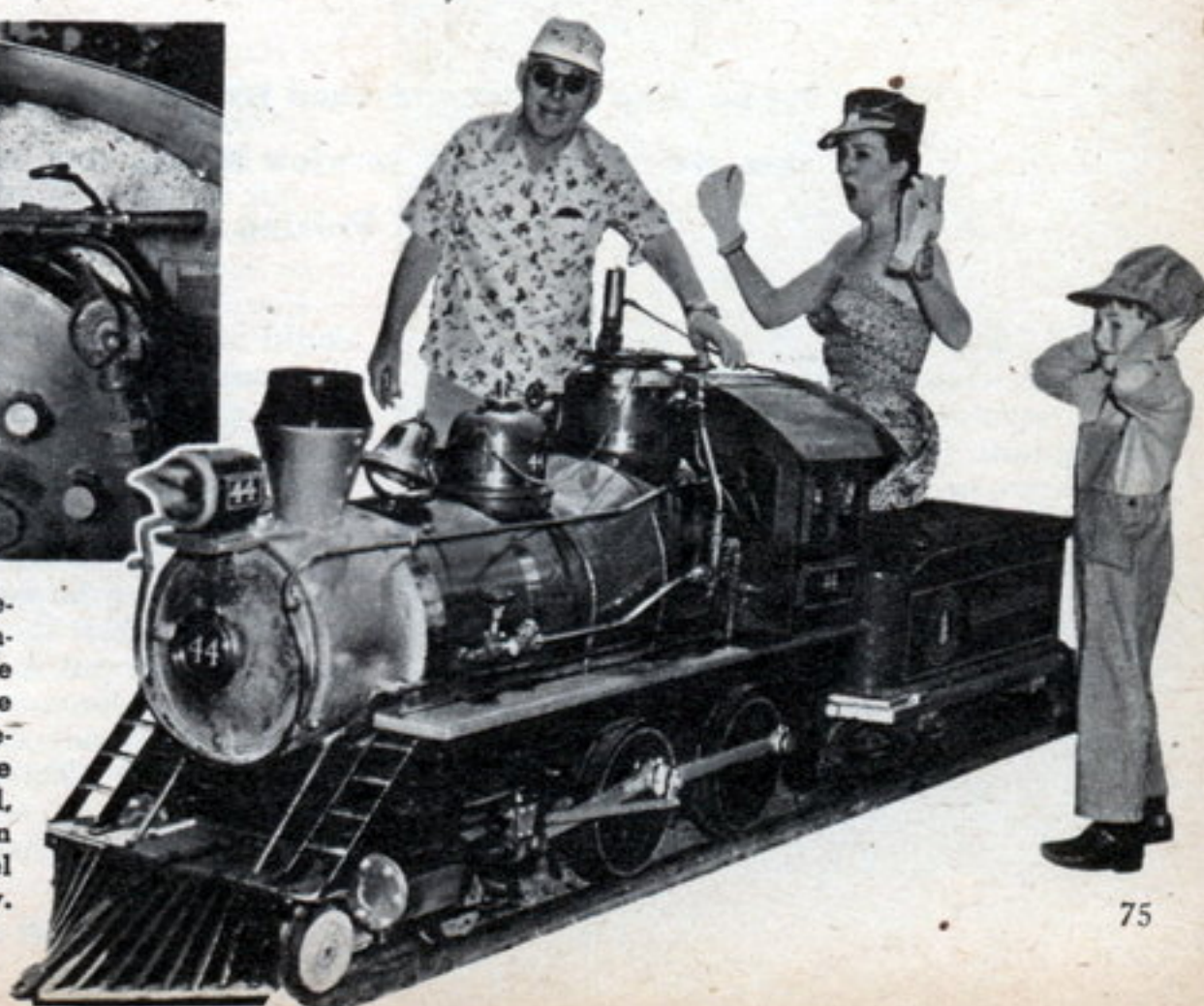
Old 45 swings on a specially designed turntable as it heads for the miniature L & C roundhouse. Cannonballs from Civil War serve as ball bearings.



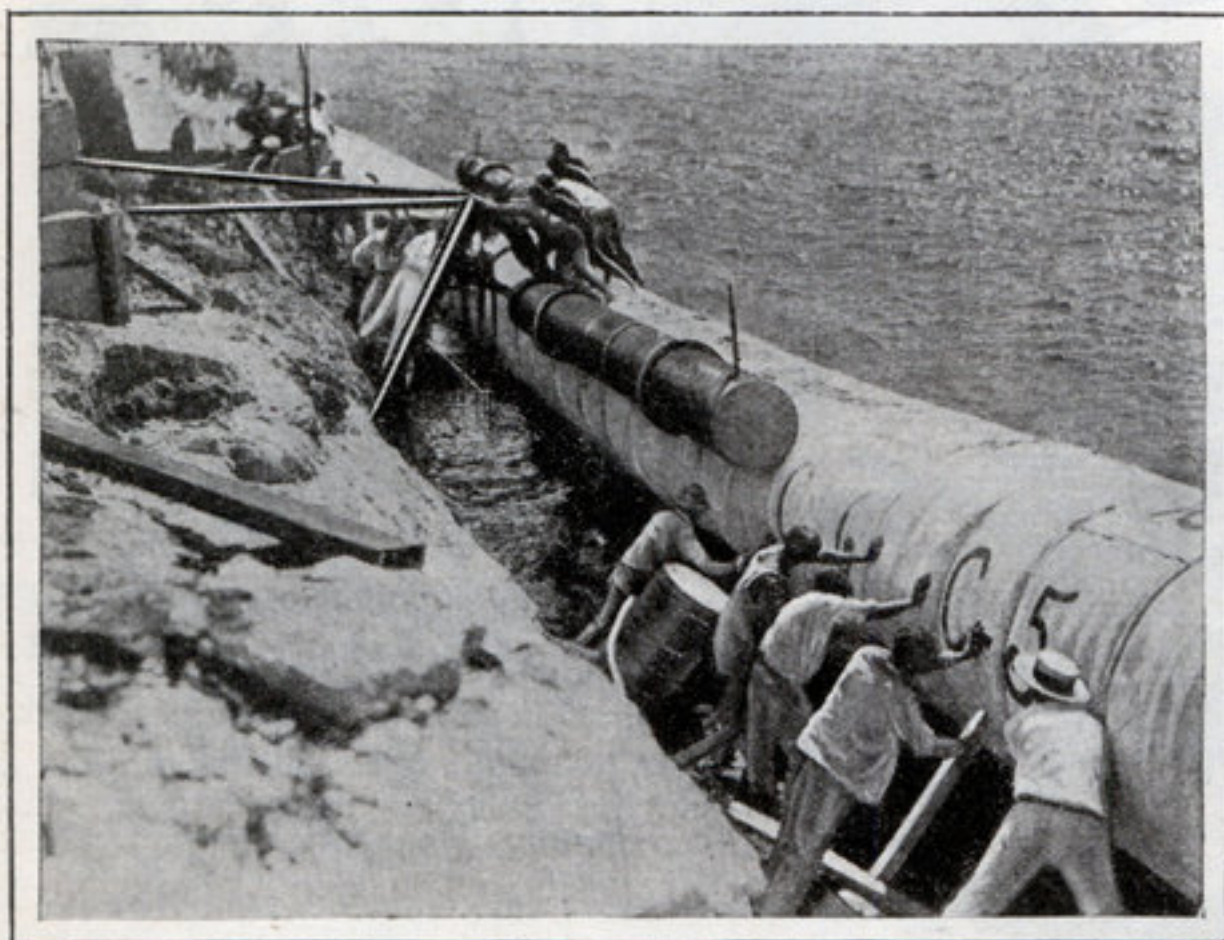
Yard of this Lilliputian railroad rivals those of regular-sized lines. Note the efficient layout of the switches, water tower and roundhouse.



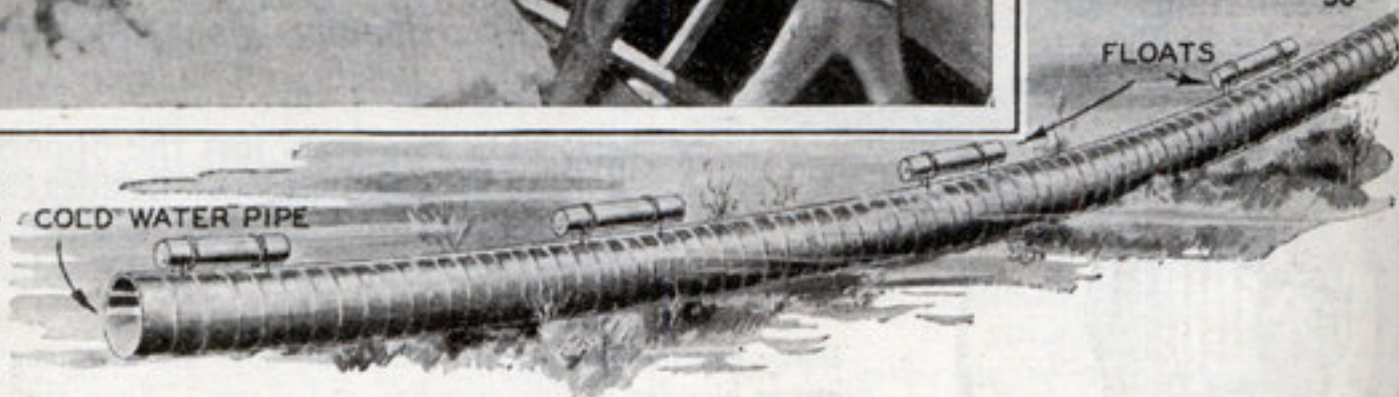
Gypsy Rose Lee, right, vice-president in charge of unveiling, thought she'd like to be an engineer but she threw up her hands in despair after looking over the complicated control board, above. Genial gentleman assisting her is Colonel Elliott Springs, RR's prexy.



Harnessing the Power



Lowering one of the water pipes for the Claude power project in the sea off Matanzas, Cuba.



When coal mines are exhausted, where is industry to obtain the power to keep its wheels turning? What sources of power are now lying dormant, waiting for some engineering genius to harness them? This important subject, of ever-present interest to scientist and layman, is fascinatingly discussed in this authoritative article.

DR. Georges Claude, brilliant French inventor, recently expended a million dollars and, after two unsuccessful attempts, succeeded in launching a mile long steel tube, some six feet in diameter, in the waters of the sea off Matanzas, Cuba. And most of the world is still wondering what he is trying to do.

The briefest answer is that Dr. Claude, who is best known in this country as the inventor of the neon lamp and sign, is attempting to harness the power of the sun.

Seems strange to go down under the sea to capture the power of the sun, but if he succeeds in doing on a large scale what he has already demonstrated in a small way

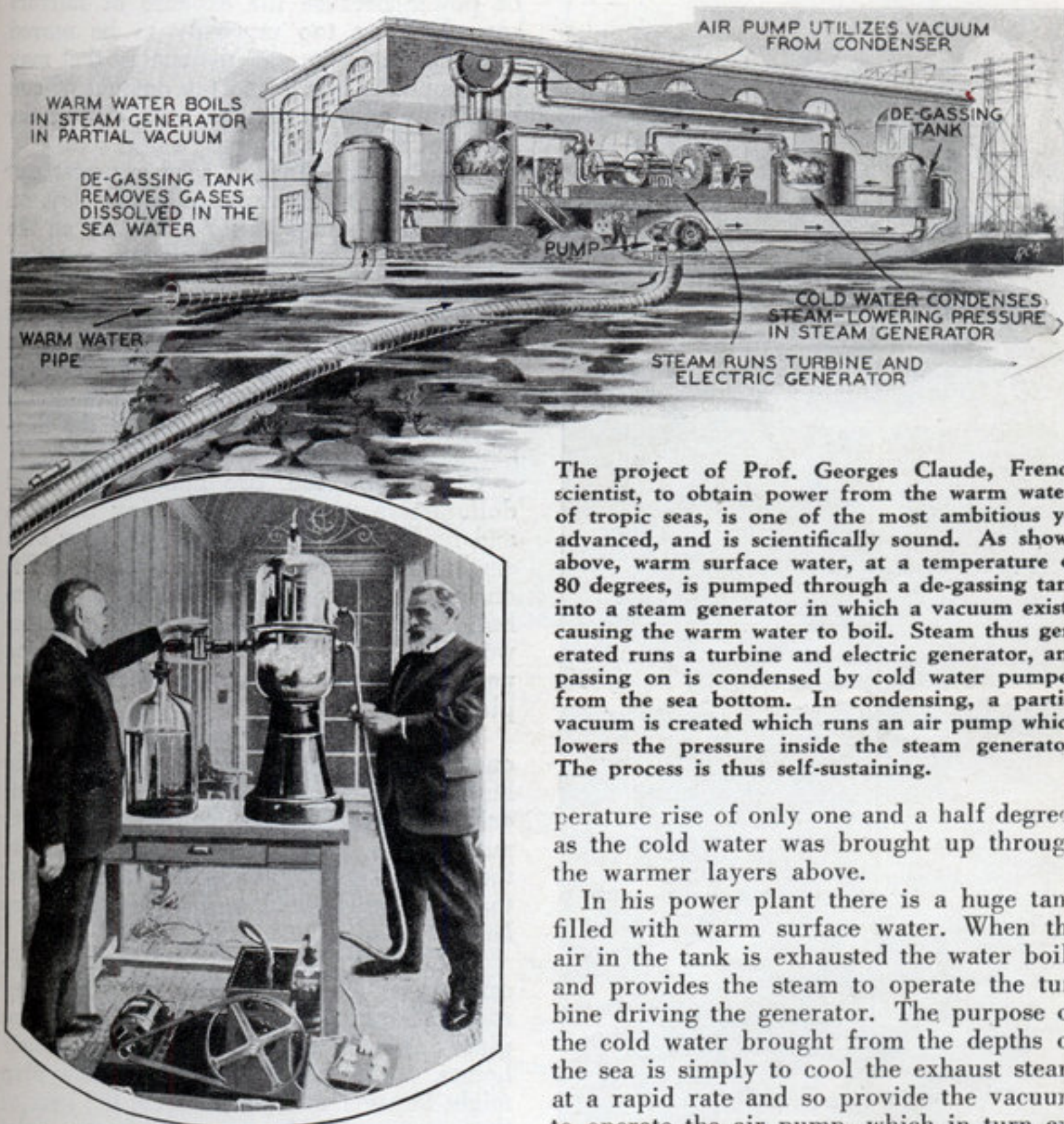
he may soon be generating enough power to run all Cuba, with a surplus to be exported by way of an undersea cable to Florida.

The sun heats the surface ocean water in the tropics to temperatures as high as 28 degrees, Centigrade, while 400 meters down the sea is as cold as 4 degrees, Centigrade. If the two bodies at different temperatures could be brought together water could be boiled, in a partial vacuum, producing power equivalent to a 300-foot waterfall.

In demonstrations before the Havana Academy of Science last year Dr. Claude showed that with the difference in temperature between ice at melting point and water

of the SUN

Future Sources of Power
Described by
WILLIAM J. HARRIS



Prof. Claude, best known in America for his invention of the neon sign, is shown at left above demonstrating a model of his power apparatus.

at 68 degrees Fahrenheit—a difference of 36 degrees, sufficient vapor was released to run a small turbine at 5,000 r.p.m.

Following the launching of the tube Prof. Claude announced that 4,000 cubic meters of deep sea water was being obtained each hour, at a temperature of 13 degrees Centigrade. The actual temperature at the lower end of the tube, 650 meters below the surface, was 10½ degrees, so there was a tem-

The project of Prof. Georges Claude, French scientist, to obtain power from the warm waters of tropic seas, is one of the most ambitious yet advanced, and is scientifically sound. As shown above, warm surface water, at a temperature of 80 degrees, is pumped through a de-gassing tank into a steam generator in which a vacuum exists, causing the warm water to boil. Steam thus generated runs a turbine and electric generator, and passing on is condensed by cold water pumped from the sea bottom. In condensing, a partial vacuum is created which runs an air pump which lowers the pressure inside the steam generator. The process is thus self-sustaining.

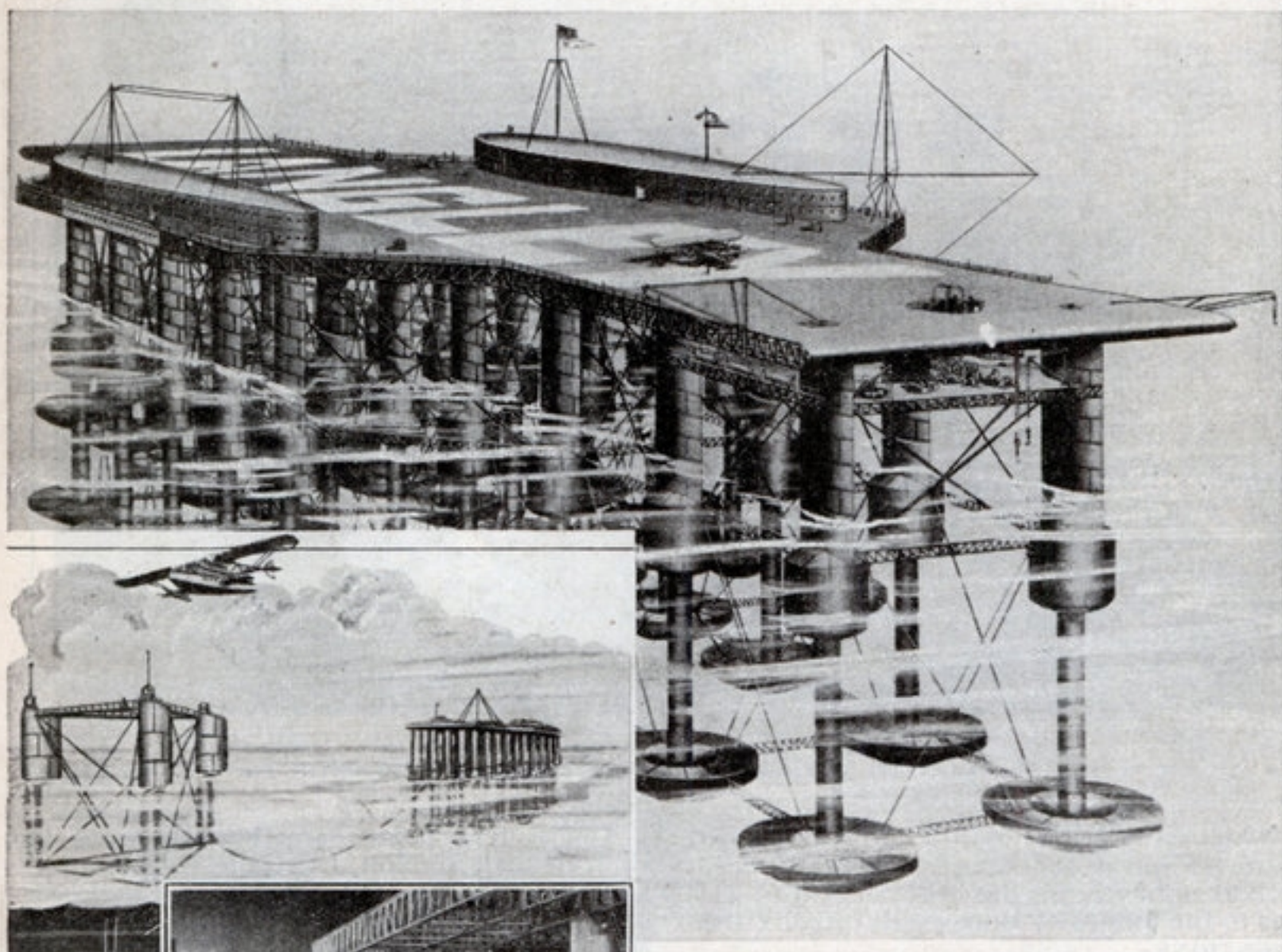
perature rise of only one and a half degrees as the cold water was brought up through the warmer layers above.

In his power plant there is a huge tank filled with warm surface water. When the air in the tank is exhausted the water boils and provides the steam to operate the turbine driving the generator. The purpose of the cold water brought from the depths of the sea is simply to cool the exhaust steam at a rapid rate and so provide the vacuum to operate the air pump, which in turn exhausts the air from the warm water tank, and so converts the process into an endless chain.

The present plant, with a 50 kilowatt generator, is only an experimental affair, and, if successful, probably will be abandoned in favor of a much larger one located at some other spot in Cuba.

Sun motors, usually huge collections of mirrors set to capture the sun's rays over an area of many hundred square feet and focus them on a small spot, are not new. Such motors are working in California and in the

FLOATING AIRPORTS

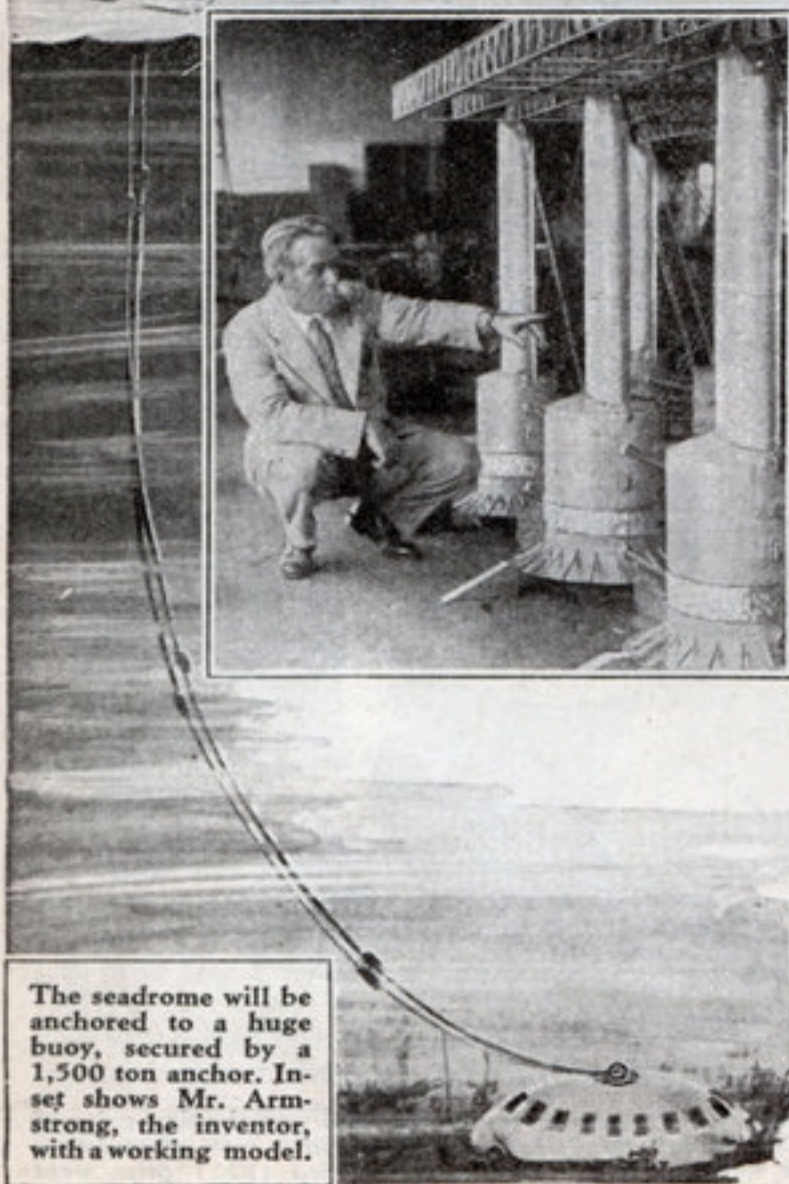


Here is what the full sized Armstrong seadrome will look like when completed. At first but one-fourth of it will be built, the more economically to test the flotation principles of the submerged ballast tanks. Later the complete six-acre field may be built, with hotels at the side as shown or else on a lower deck, according to what tests prove.

by BEN LINCOLN

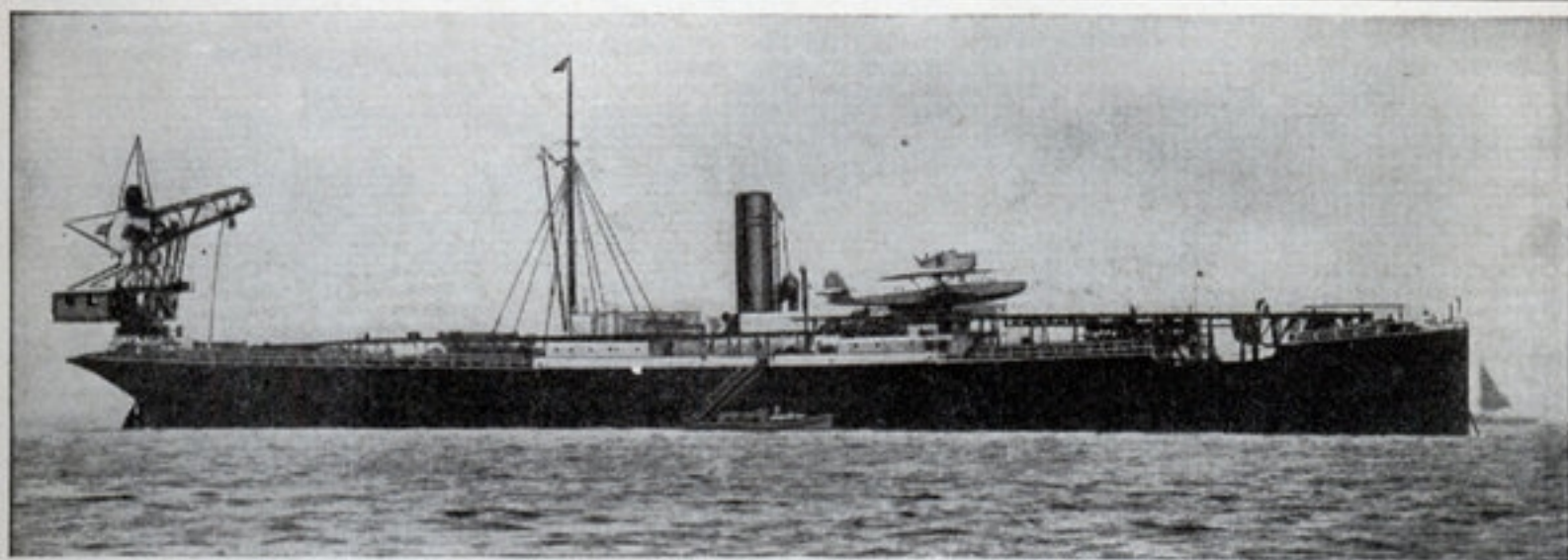
FUNDS recently appropriated by the government have put the United States Department of Commerce, Aviation Branch, squarely behind the immediate development of a chain of five floating airports which will span the Atlantic for regular airways service.

This recently announced appropriation, amounting to \$1,500,000 was negotiated by Eugene L. Vidal, Director of Aeronautics of the Department of Commerce, in behalf of Edward R. Armstrong, inventor of the seadrome, and completes a 16 year fight to gain recognition for a project which both Mr. Vidal, a competent and experienced airways operator, and Mr. Armstrong solidly believe in. As well, it will provide work for a great number of unemployed, as 80 per cent of the cost of such development projects goes to labor.



The seadrome will be anchored to a huge buoy, secured by a 1,500 ton anchor. Inset shows Mr. Armstrong, the inventor, with a working model.

to LINK CONTINENTS



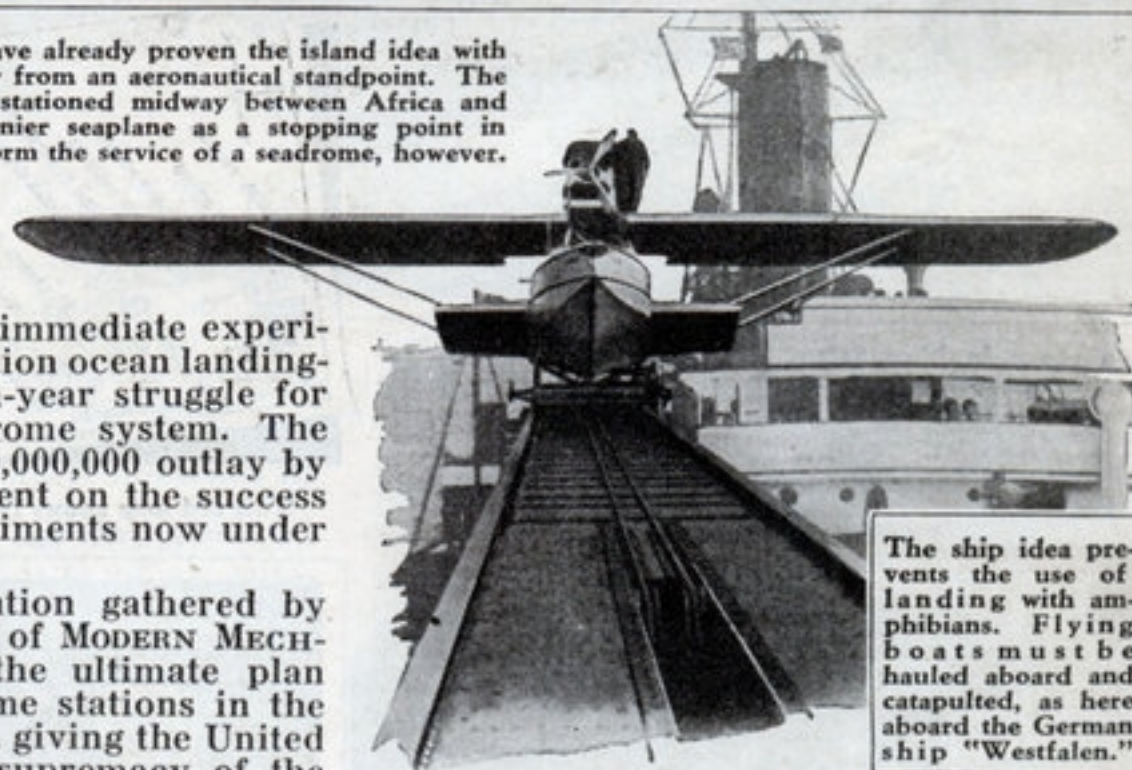
The ever enterprising Germans have already proven the island idea with a ship, thus proving the feasibility from an aeronautical standpoint. The "Westfalen," shown above, was stationed midway between Africa and South America, serving the Dornier seaplane as a stopping point in a recent flight. Ships cannot perform the service of a seadrome, however.

This \$1,500,000 is for immediate experiments with a quarter-section ocean landing-field and ends a sixteen-year struggle for recognition of the seadrome system. The final plan calls for a \$30,000,000 outlay by the government, contingent on the success of the preliminary experiments now under way.

According to information gathered by this member of the staff of MODERN MECHANIX AND INVENTIONS, the ultimate plan calls for similar seadrome stations in the Pacific and other oceans, giving the United States an international supremacy of the air lanes. Great Britain and France both gave the Armstrong plan serious consideration but failed to adopt it.

The proposed system calls for five Armstrong seadromes at 500 mile intervals from the Atlantic seaboard here to the western coast of Europe. Each drome will cost \$6,000,000.

Back in 1927 when Armstrong completed his first models of the floating deck, he

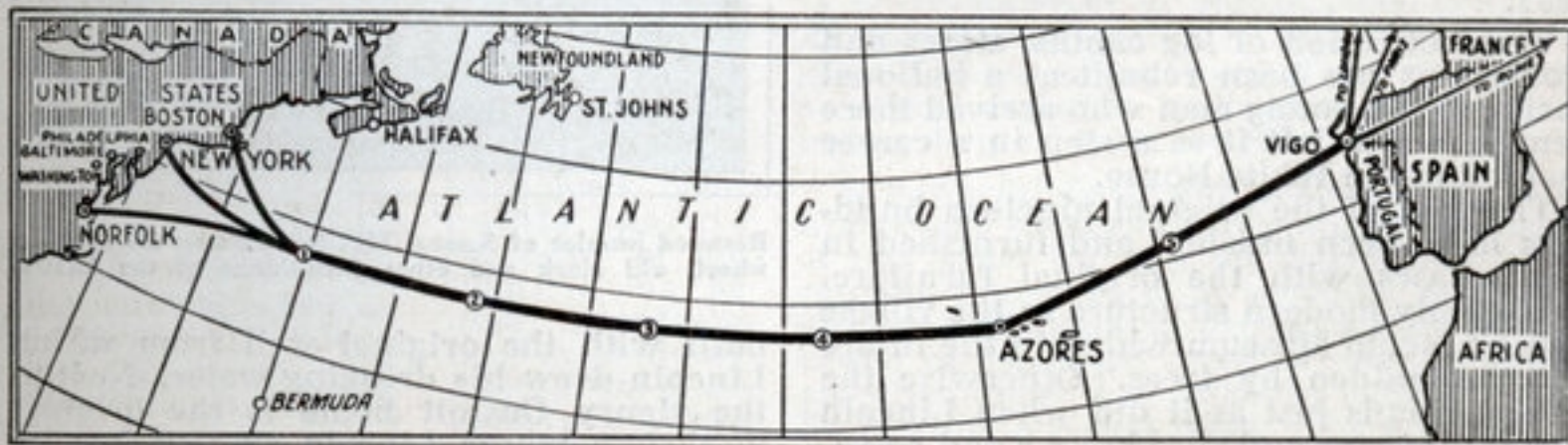


The ship idea prevents the use of landing with amphibians. Flying boats must be hauled aboard and catapulted, as here aboard the German ship "Westfalen."

intended to have hangars and hotels on the six-acre surface. But the design which has been accepted by the government calls for a vacant deck, with hangar and hotel accommodations confined to two or three decks below the surface.

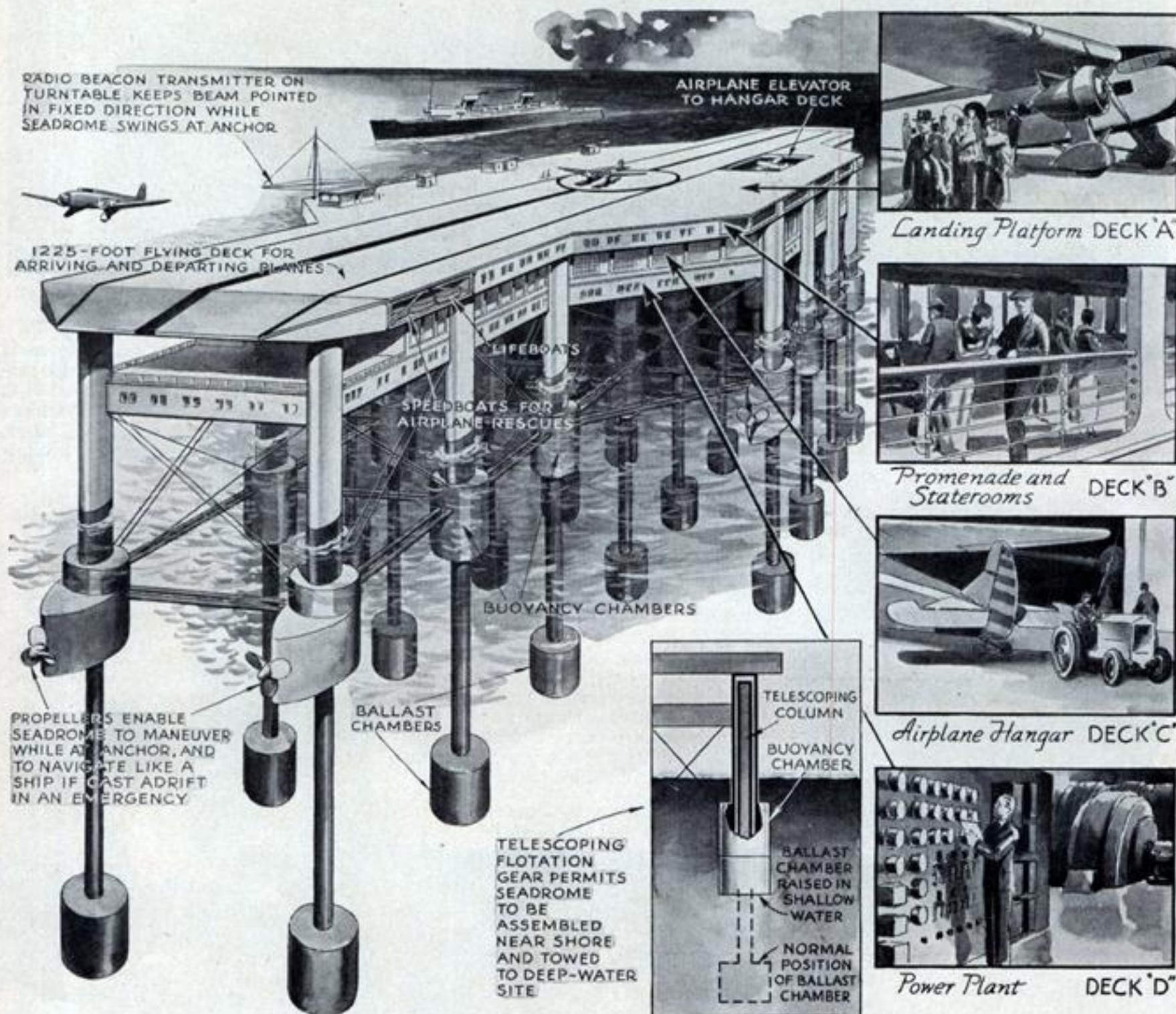
The seadromes will be 1,225 feet long and 300 feet wide. An elevator will take planes

(Continued on page 138)



Eventually, if tests prove successful, the government seadrome chain would dot the Atlantic as shown for 30-hour service between Europe and America. These five seadromes would be situated in fair weather latitudes 500 miles apart.

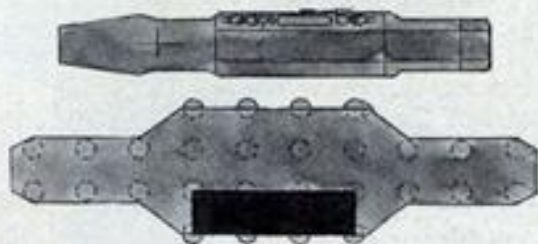
UNCLE SAM ASKED TO BUILD Floating Ocean Airports



This illustration shows the design and construction of the latest model of the Armstrong seadrome which the Government recently was reported ready to try out. Note the arrangement of the four decks

REDESIGNED and improved since its earlier forms were described in this magazine, a new type of "seadrome" or floating airport, is proposed by its inventor, Edward R. Armstrong, as the basis of a modernized plan to bridge the Atlantic with a string of artificial islands. His project, which has attracted the interest of U. S. Government officials, is intended to provide twenty-hour airplane service between America and Europe. It calls for the anchoring of five of the seadromes between America and Spain, at about the latitude of Washington, D. C., to serve as refueling stations about three hours' flight apart. Planes using these islands in stepping-stone fashion could transport heavy pay loads at high speed, since their loads of gasoline would be light.

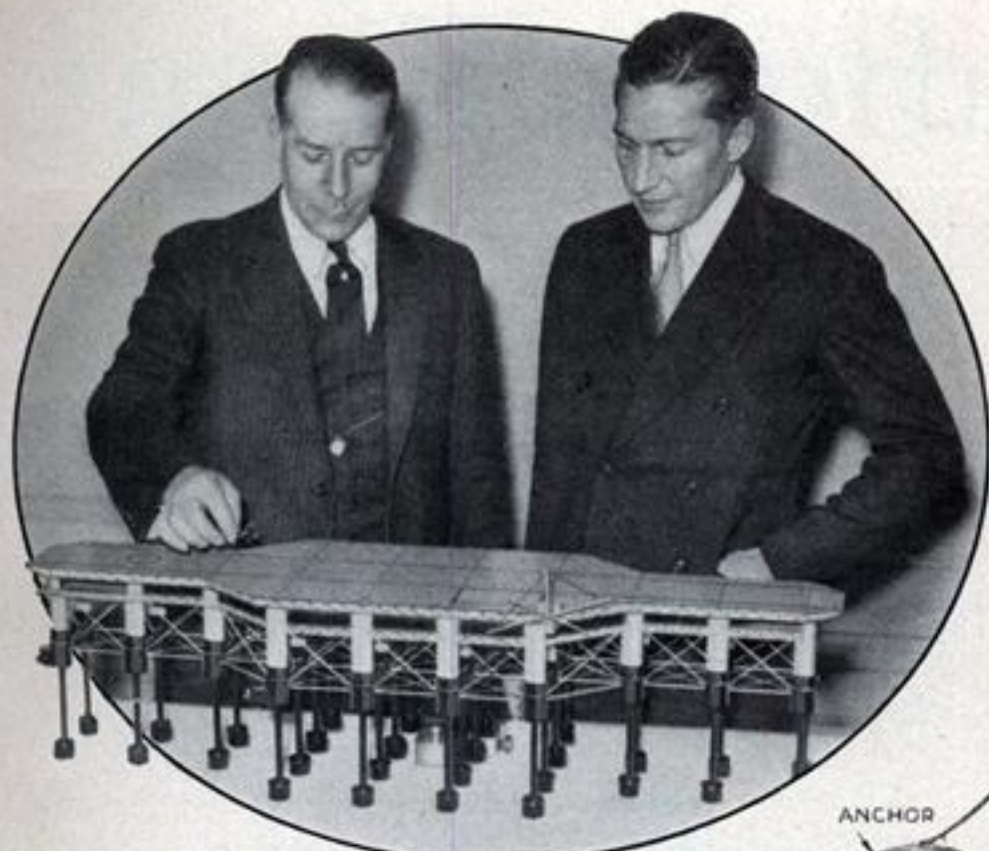
On these pages our artist shows the details of the latest type of seadrome proposed by Armstrong, in seeking Federal aid for his project. The 1,225-foot airplane landing platform, supported 100 feet above the water on twenty-eight submerged buoyancy tanks, would not



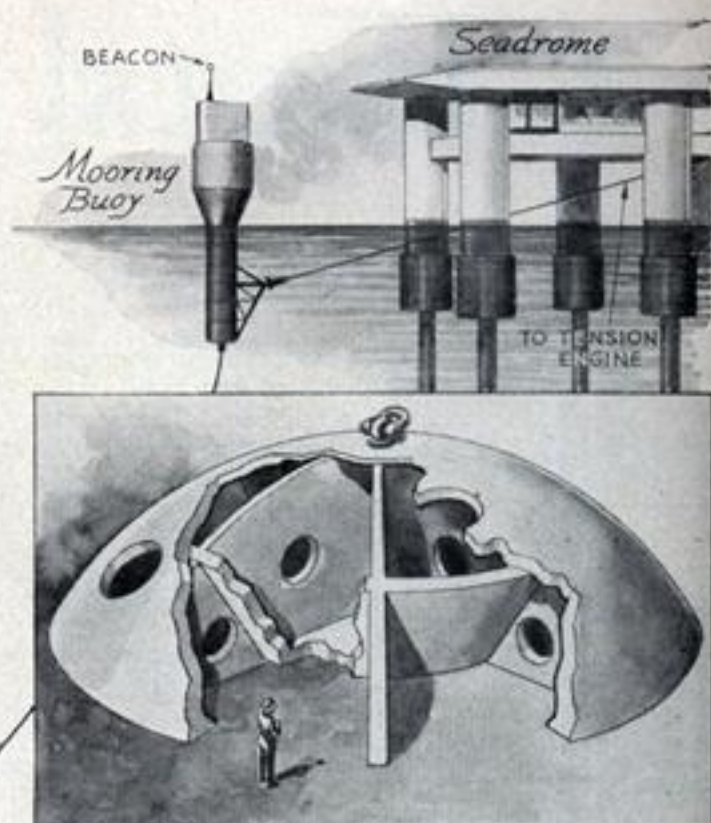
Landing area of seadrome compared with that of an aircraft carrier. Shaded section shows the first part that will be built

pitch and toss in stormy weather, Armstrong declares, because its supporting buoys float beneath the area of the sea that is subject to wave motion and its openwork structure allows waves to pass unhindered beneath its decks. These facts he has verified by experiments with models up to thirty-five-foot size. Each seadrome would have overnight accommodations for 100 travelers, in addition to quarters for its own crew and hangar space for fifty large transport planes. Run like a ship, the seadrome would have a captain, first officer, second officer, seamen, and engineers, as well as two meteorologists and a physician.

Any type of plane—land plane, sea-plane or flying boat—could use the seadromes as refueling stations, although Armstrong himself believes that a special-



Edward R. Armstrong, left, designer of the seadrome, points out some of its principal features to Eugene L. Vidal, director of aeronautics of the U. S. Department of Commerce



It is planned to hold the seadromes in place by mooring buoys connected by cables with anchors of novel type that would be floated to sea and then sunk in place

ized type of amphibian plane will be developed for this purpose. Aircraft will be guided to the island airport by a standard type of radio beacon, which is mounted on an automatic turntable controlled by a gyro compass. No matter how the seadrome may swing at anchor, the beam will always point in a fixed direction. Another innovation not found in his earlier plans is an emergency propulsion system that enables the seadrome to navigate like a ship if it is necessary to cast the seadrome adrift to ride out a storm of phenomenal severity, or if it should break

loose from its moorings. This is provided by four propellers, each operated by a 500-horsepower electric motor that is supplied with current from the seadrome's gasoline-electric power plant.

To anchor his seadrome, Armstrong proposes to float a 1,660-ton anchor of steel and concrete to sea, and sink it on the selected site by opening ports that allow water to rush into its inner chambers. Heavy steel cables moor the seadrome to a buoy that, in turn, is attached to the anchor. A tension engine on the seadrome takes up the slack on

the cable so that it will not foul the understructure, paying it out automatically in response to a sudden strain.

Present plans call for a section one-fourth the size of a finished seadrome to be built and anchored at sea for final tests, including attempts to land upon it with a plane. If these are successful, the Government may be sufficiently interested to take over the project and build and operate the whole seadrome chain itself. Experts in international law believe the United States would have a right to anchor the islands on the high seas.

Builds Odd Land-Ship for Duck Hunting

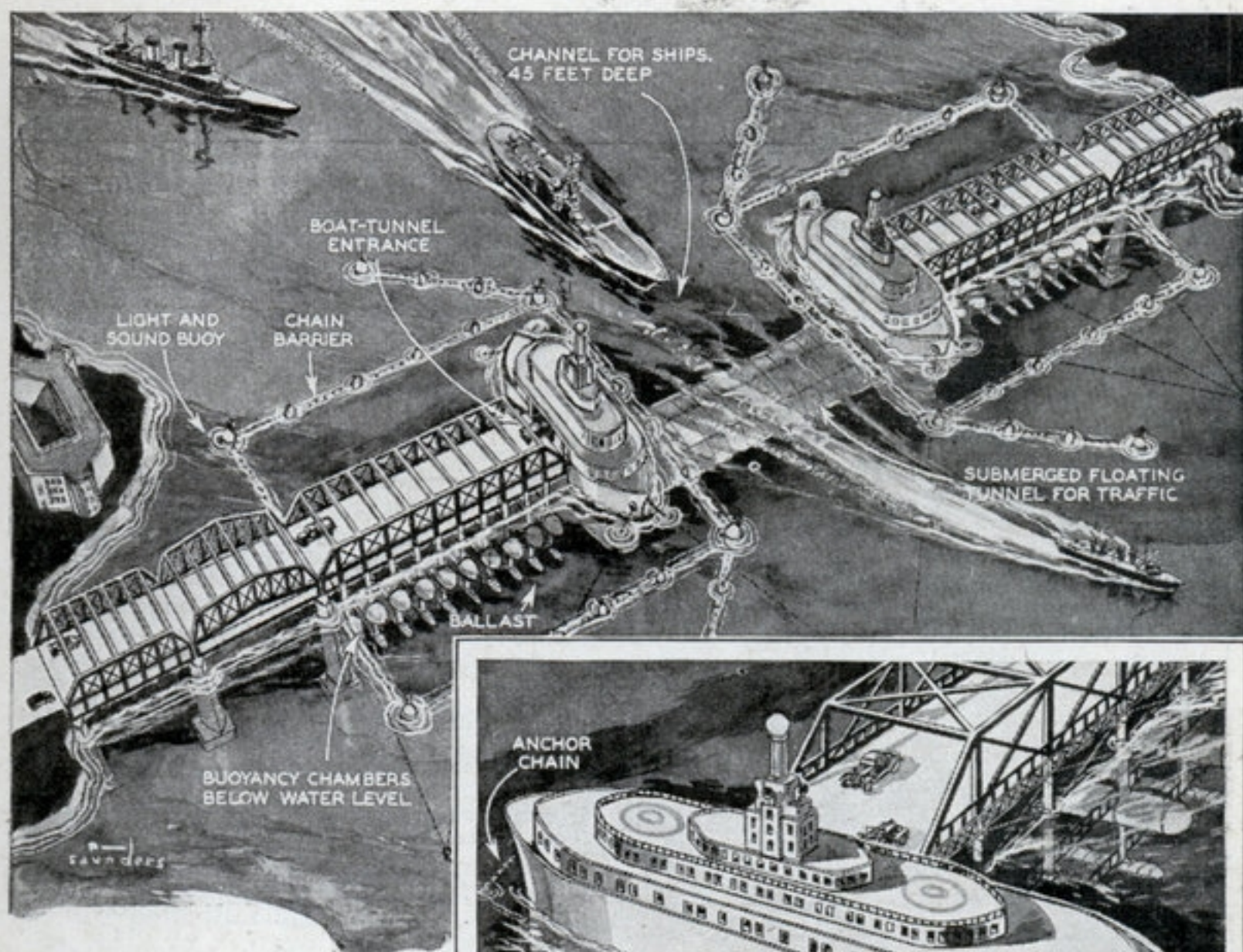
At right are two views of an amphibian vehicle. One shows it on land, the other as a water craft



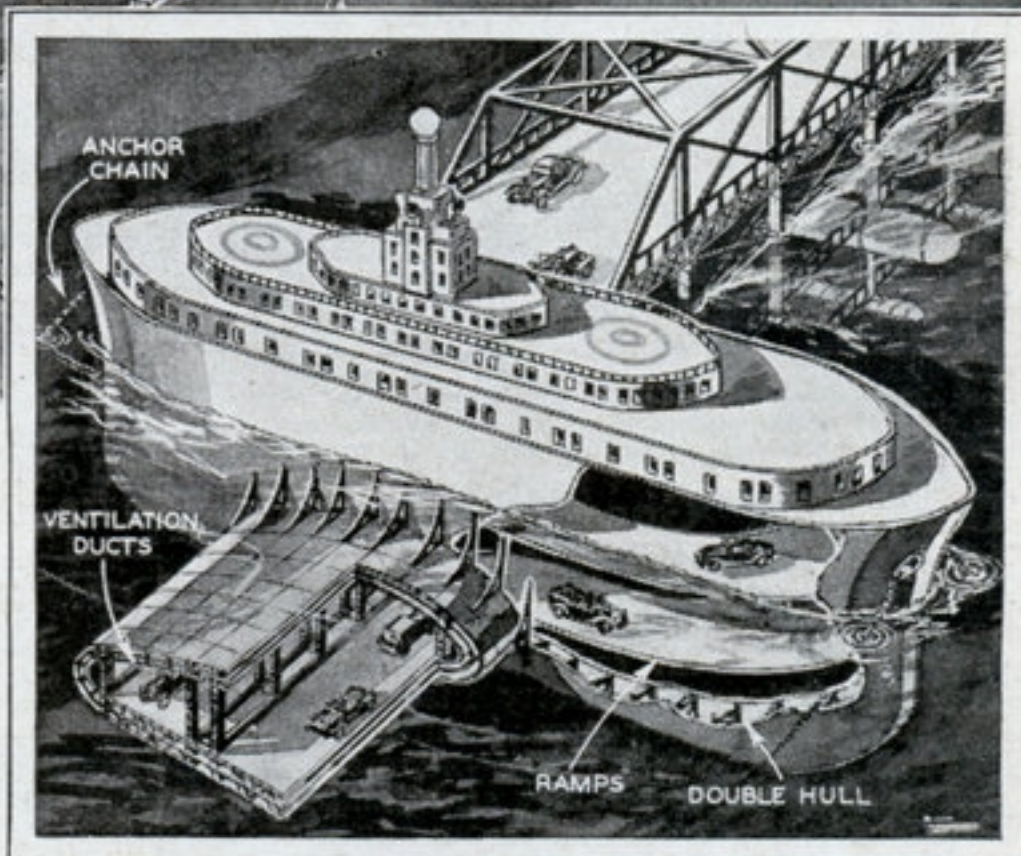
AUTOMOBILE and boat are combined in a curious "land ship" built by Emil Johnson, of Salt Lake City, Utah. Driven by an air propeller, it is said to attain sixty miles an hour on land and forty miles an hour in the water. For aquatic use, the three rubber-tired wheels are raised and the vehicle floats upon its watertight hull. Because of its shallow draft, the inventor believes his machine would prove of service in duck hunting, and would enable a hunter to drive home after a day's outing.



"BOAT TUNNEL" for Harbor Crossing



Drawing above shows how the boat tunnel would be constructed at the Golden Gate. Short bridge sections on piers are built out from either shore; then comes a floating bridge unit supported on pontoons; then a boat from whose hull extends an underwater tunnel to connect with another boat and similar units extending to the other shore. At right, close-up of the boat showing spiral ramp entrance to tunnel.



PROPOSED as a substitute for the suggested Golden Gate suspension bridge at San Francisco is an ingenious boat tunnel of unique design which, it is claimed, can be built for one-third the estimated \$35,000,000 cost of a suspension bridge. This and other advantages of the design have led authorities to consider seriously the erection of the boat tunnel bridge, which would be the only one of its kind in the world. It was conceived by Cleve F. Shaffer of San Francisco.

The plan comprises a combination of several short truss spans of ordinary construction, two seadrome type floating sections, the boat tunnel, anchorages and protective barriers. The two seadrome members are simply long platforms supported above the waterline by columns resting on buoyancy chambers below the surface.

Connected to and between the platform members is the boat tunnel section, consist-

ing of a 1200-foot tubular tunnel floating 45 feet below water level, joining the two hulls. Inside the hulls are ramps at 4% grade on which automobiles travel up or down in high gear.

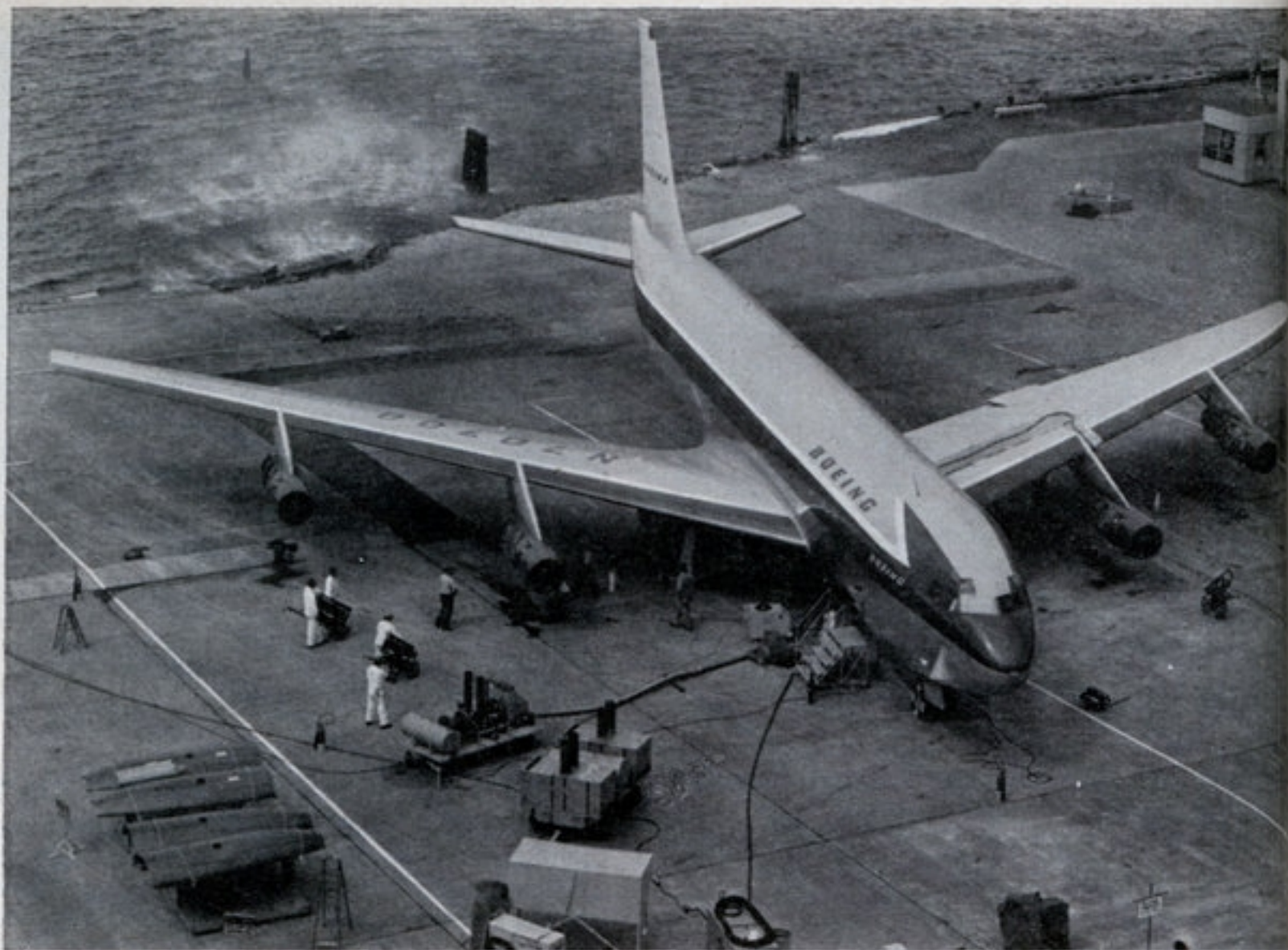
The advantage of this design to shipping is apparent, since a clear channel 1000 feet long and 45 feet deep is open at all times.

As a protection to the hulls and floating sections of the bridge, a resilient chain barrier would be hung from anchored buoys carrying lights and sound warnings. Because of strong tidal currents the floating units would have to be anchored in solid rock, and provision has been made for automatic motors to take up slack in the anchor lines. Underwater stresses are greatly reduced by streamline shape of the parts.

"Flying Bomb" Guided by Man Pilot



GUIDED by a human pilot, a "flying bomb" designed by Lester P. Barlow, well known aerial munitions expert, would enable one man to destroy a battleship and escape alive, according to the inventor. The new aerial weapon consists of a small airplane-like structure, featuring wings, rudder and elevator controls, to which a 3,500-pound bomb is fitted as a nose. Released from a bombing plane at an altitude of 10,000 feet, the "flying bomb" would be glided to a position directly over its objective, whereupon the pilot would place the craft in a vertical dive, release the bomb nose-piece and escape by parachute to the surface of the sea where he would float about on a specially designed rubber raft until picked up by a patrol boat.



Technicians check thrust of one of the four powerful engines. Exhaust kicks up miniature storm in water

ON TRIAL - - -

America's First Jetliner

By A. M. "Tex" Johnston
Chief of Flight Test, Boeing

as told to Thomas E. Stimson, Jr.

CRASH BOATS are standing by off Mercer Island!" "All airports in vicinity of Seattle are closed to normal traffic!" "Rescue helicopter now on patrol off Seward Park!" "Fire fighters standing by!"

"Your chase plane is airborne!"

Reports like these were part of the pre-flight preparations in July when copilot "Dix" Loesch and I prepared to streak down the concrete runway at Renton Airport and lift the prototype of America's first jetliner into the air on its initial test flight.

Boeing's 707 "Jet Stratotanker-Stratoliner" is considered the safest passenger transport ever built, yet Dix and I were happy about the elaborate precautions to rescue us if anything went wrong. All our recent preflight and ground tests had been perfect. We were expecting a normal rou-

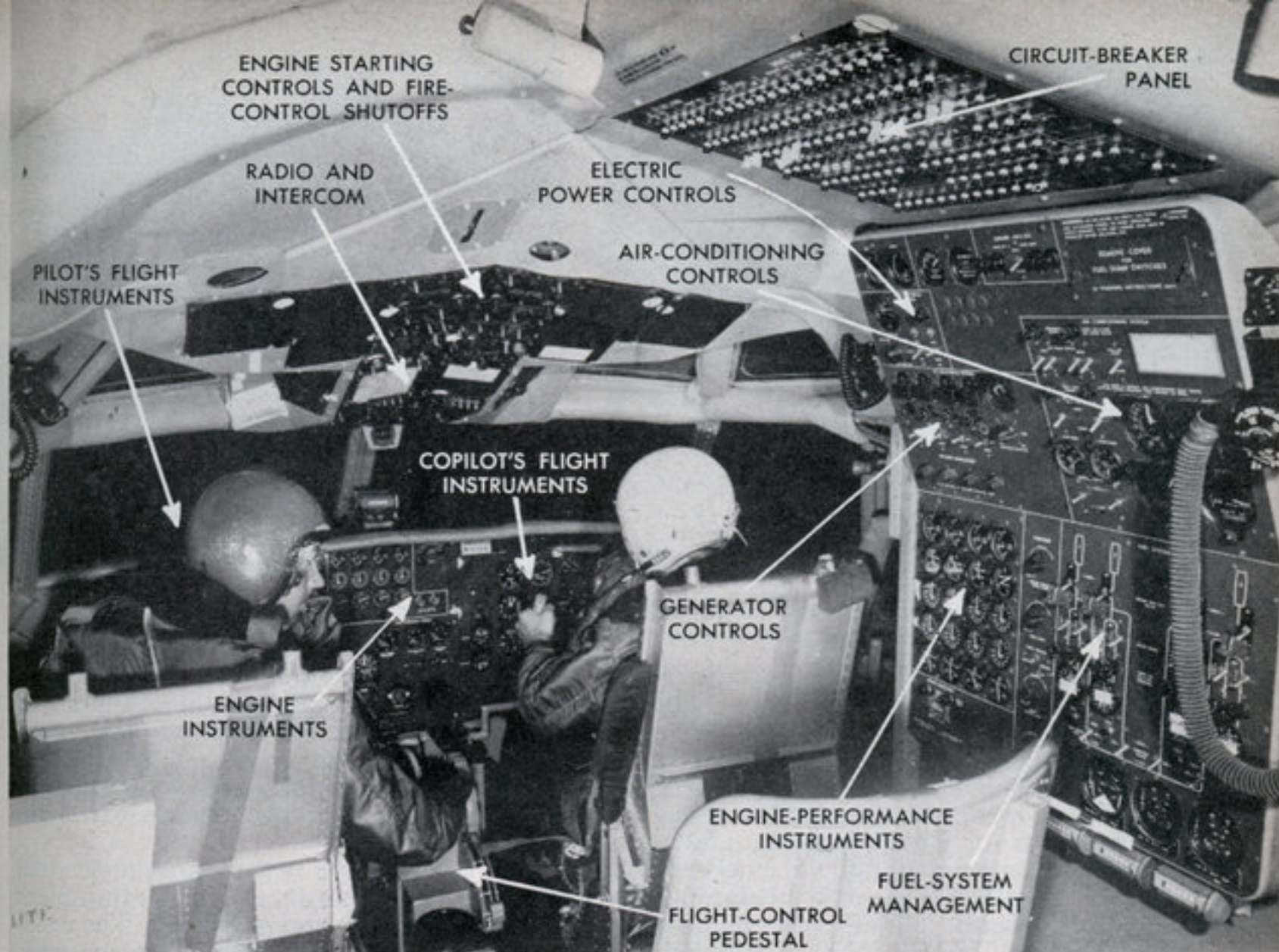
tine ride on the first flight, but there's always a chance that the unexpected can happen.

And the unexpected did happen during an early taxi test. A landing gear strut unexpectedly folded up. The plane skidded along the runway on one wing for a few feet and the whole test program was delayed during repairs.

For the first flight test, it was comforting to know that the crash boats carried diagrams of the fuselage with "Chop Here" information, and that fire fighters were standing by even though we wouldn't need their help. We had landing priority at any airport within 50 miles and, as a final precaution, we were wearing parachutes.

All of this is routine procedure at Boeing when a new design is being flown for the first time. In this case the precautions were



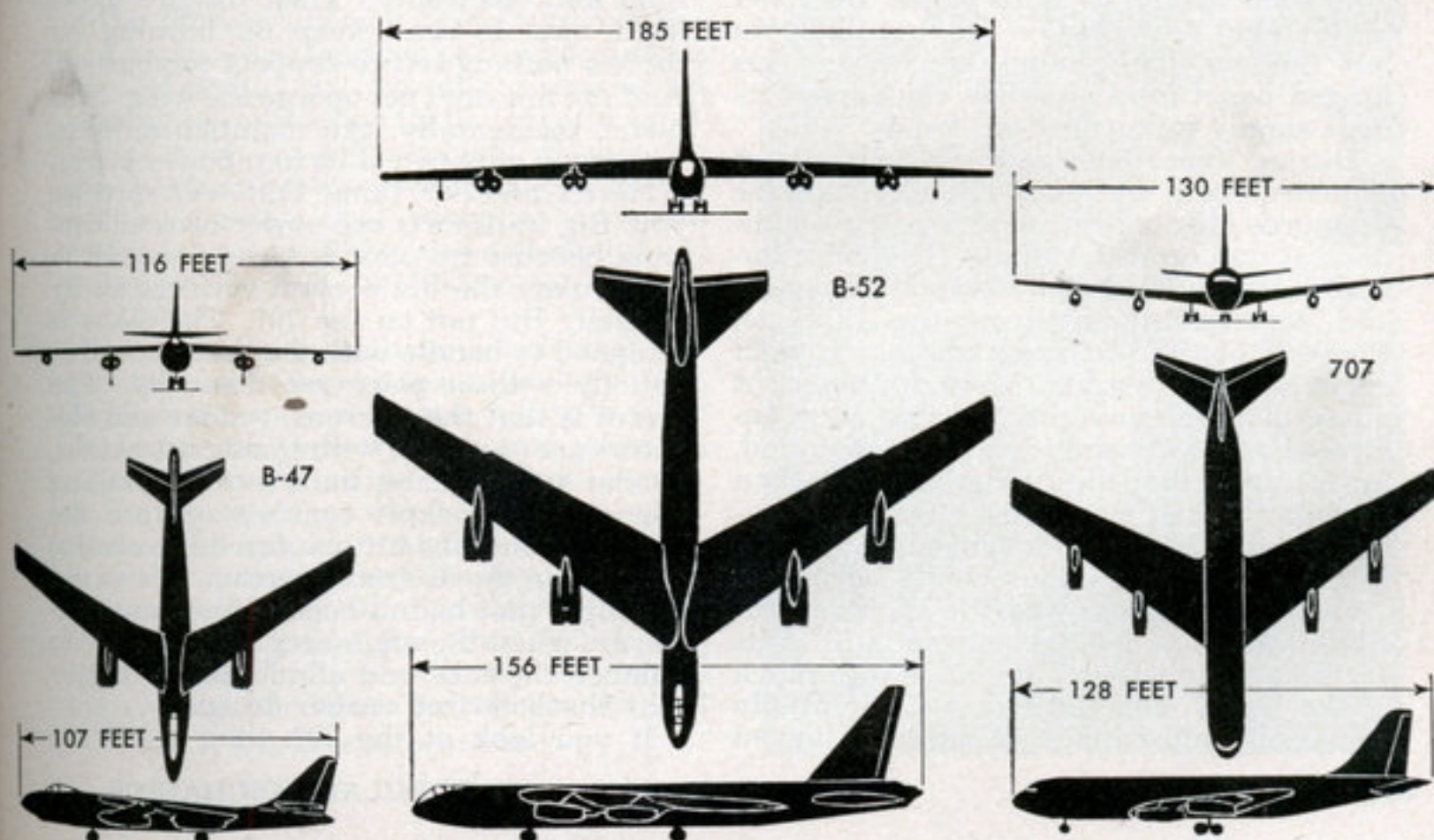


Cockpit appears to be jammed with controls, but actually has fewer instruments than a big piston-engine plane

still has the good low-speed performance of piston-engine aircraft. It can climb out of a field as fast as most transports can cruise. It can make a steep, slow approach for a landing, then brake to a minimum stop.

During the rest of this summer Dix Loesch and I will complete its Phase I testing. Among other things, this involves

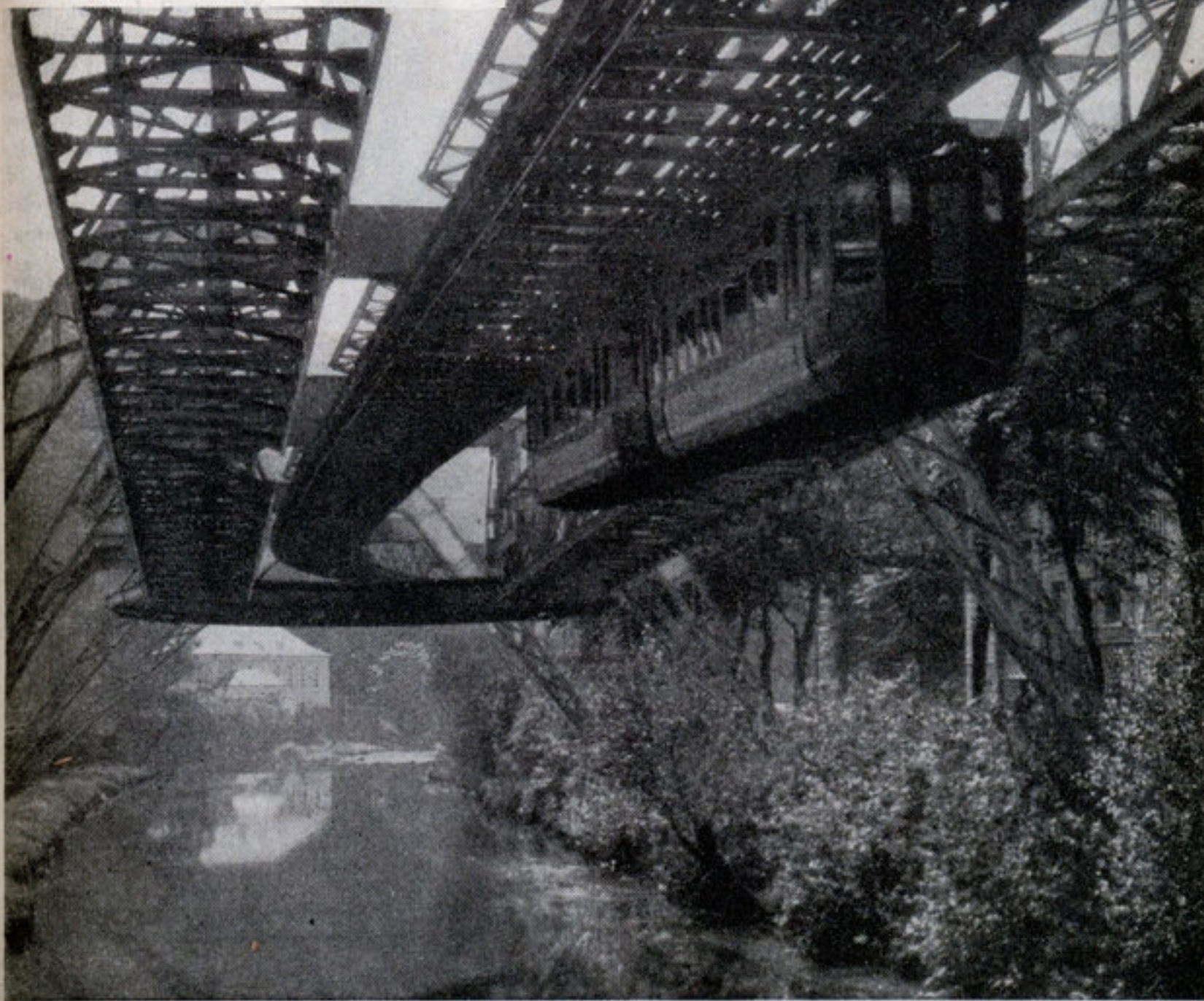
proving its performance, stability and altitude capabilities. We will find out how closely it meets the specifications to which it was designed. Take-off and landing distances will be measured, as will its Mach number and indicated air-speed limitations. We'll check flutter characteristics, if any, in all speed ranges and under all conditions



SCIENCE and MECHANICS

The Magazine That Shows You How

FEBRUARY, 1946



Ewing Galloway photo

MONORAIL Comes of Age

By PHIL GLANZER

IMAGINE boarding a sleek, gleaming car and speeding to your office or home at 200 miles an hour—noiselessly and without a jar!

Imagine living out in the wide open spaces where you've always wanted to live, away from the crowds and smoke and noise of cities—even

The printer didn't get this picture turned wrong way up. What you see is a monorail train at Elberfeld, in Germany. The train runs under, not over, its elevated track.

a hundred miles distant from your work, yet only a half-hour commuting-time away.

Imagine crossing the continent in nine hours at 300 miles an hour, at a cost of not more than a cent a mile!

Does all that sound fantastic? Perhaps. But in the not-too-distant future you may be able to do just those things. You may be able to climb aboard a projectile-like train in San Francisco at say, 8 a.m., and eat dinner in New York!

No, these are not dreams. They are the sound



Here the monorail, still following the river, runs through the city. Surface roads are left free for motor traffic. Even the elevated structure that supports the monorail avoids the city streets.

Ewing Galloway photo

any other form of railway yet devised. Constructed on scientific lines, it is a system which eliminates the possibility of derailment and makes for the greatest speed obtainable with comfort, safety and economy."

Monorail is not new, by any means. Europe has used it for many years and proved every claim made for it by engineers the world over. Glance at the record of a monorail line between Elberfeld and Vowinkel, in Germany.

Constructed in 1901, this line is today prac-

predictions of a group of engineers and industrialists who hold one of the most gigantic and thrilling of all post-war projects in their hands.

What is this project? Monorail. It is said to head the list on Washington's startling agenda of after-war enterprises. Recently, former U. S. Secretary of the Treasury Henry Morgenthau said: "Monorail looks like the best single buffer against post-war depression that has come to my attention."

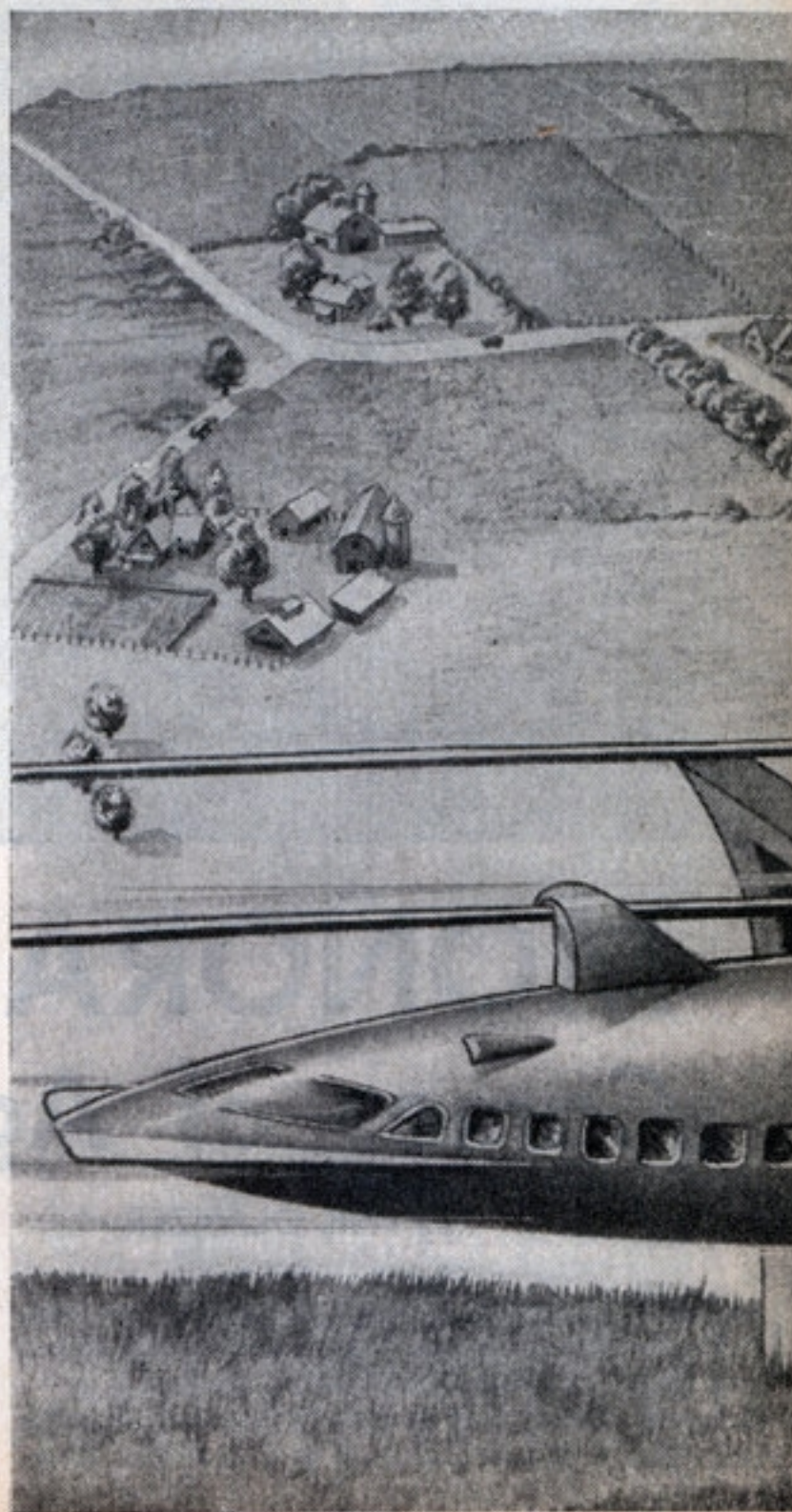
Monorail would solve many problems of the post-war period. Primarily, it would solve the urban transit problem, one of our cities' biggest headaches because of congested traffic conditions. It would also solve the problem of living too far from work. A hundred miles by monorail is comparable to 20 miles by existing methods of transportation.

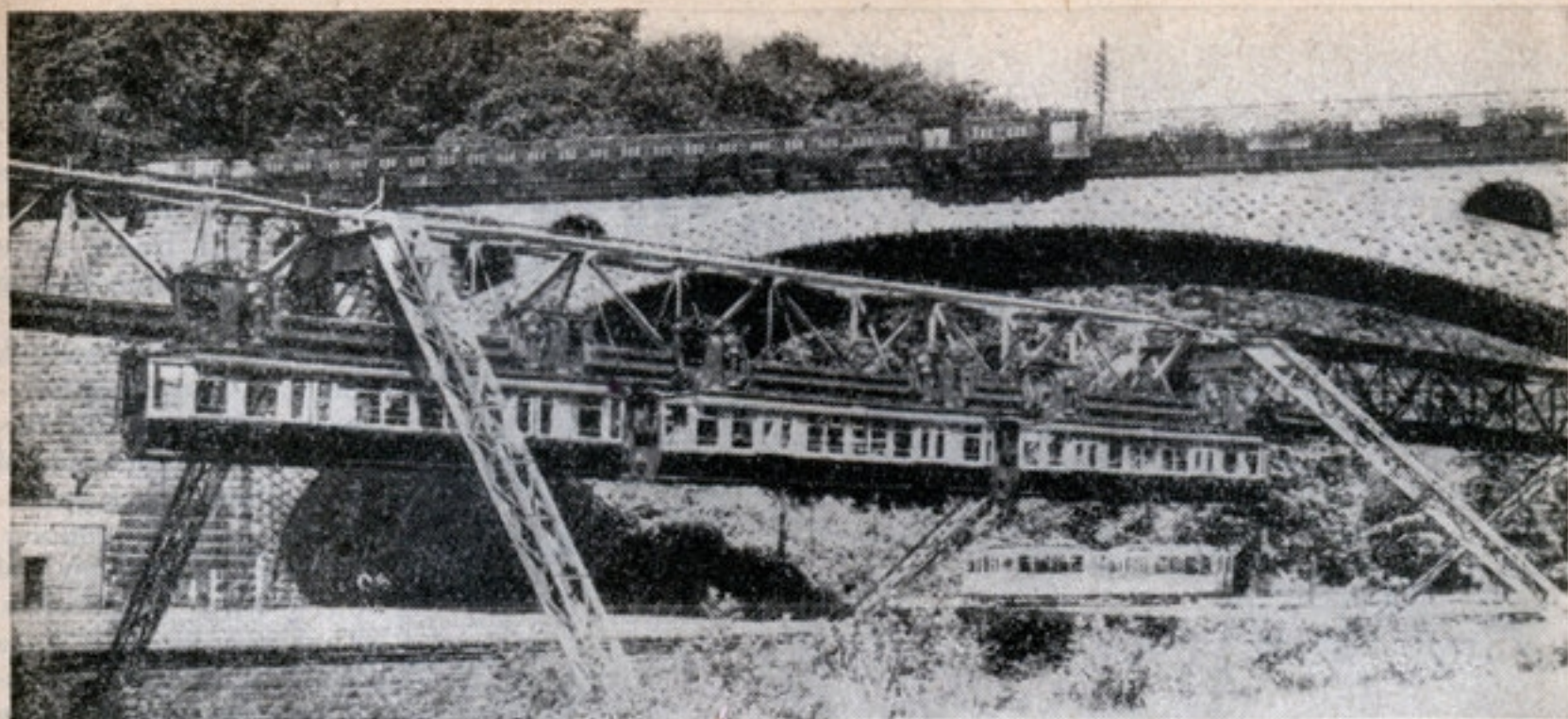
But there is another vastly important angle to monorail—post-war employment. Victory itself brings a new crisis and a new challenge to America, a challenge to provide jobs not only for the millions in the armed services, but also for the men and women once employed in war production.

Monorail is at the top as far as potential manpower requirements are concerned. It's at the top in the matter of utilization of vital commodities—steel, iron, cement, copper, aluminum, plastics, electrical supplies.

Briefly, monorail is a single steel rail suspended on rigid standards set in the earth. Its cars hang suspended from wheels riding on this rail. Of the operation of this unique transportation system, the Encyclopedia Americana says:

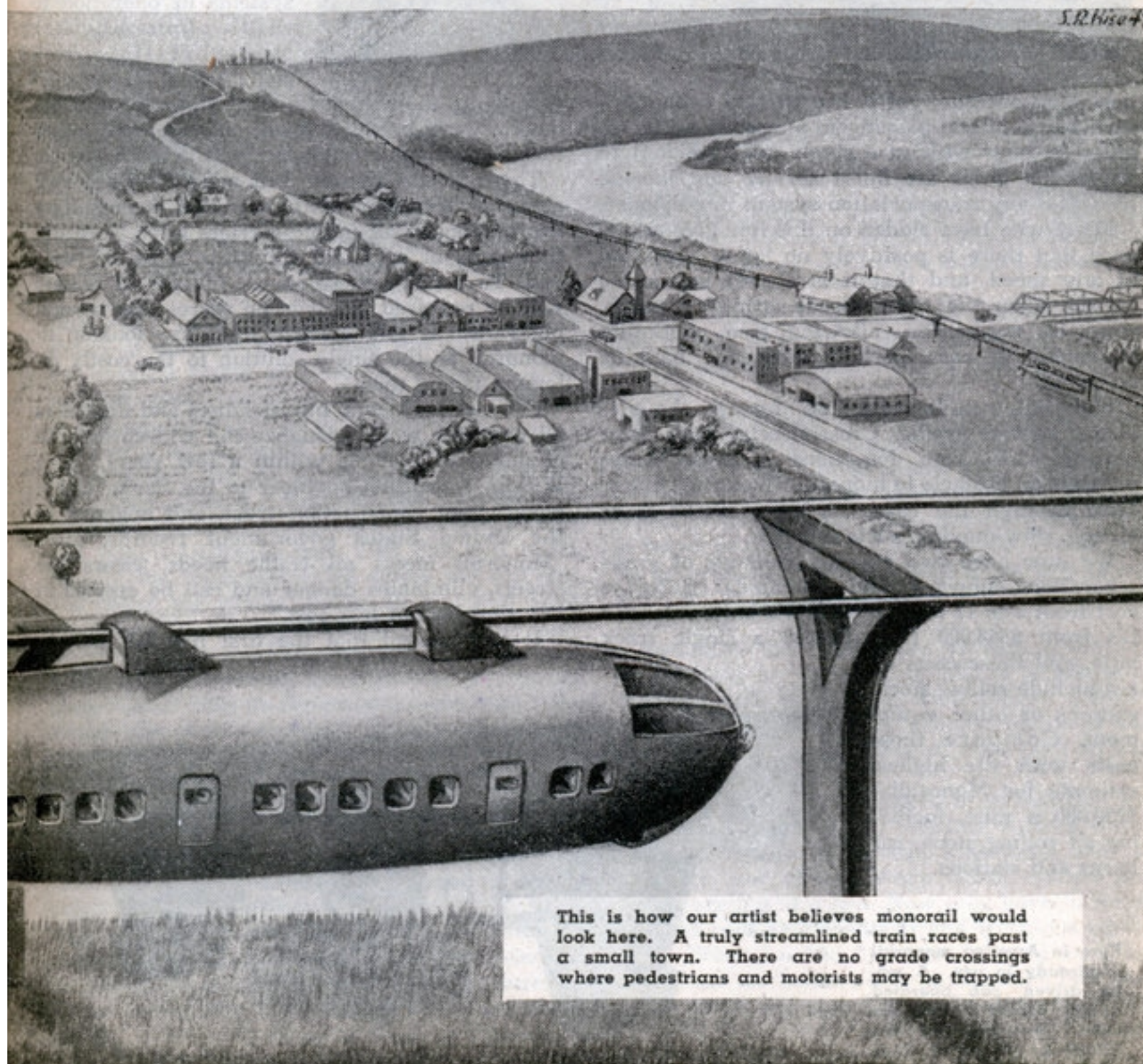
"In all the various applications of Monorail, it has been fully demonstrated to the satisfaction of the world's most eminent engineers that for speed, comfort, safety and economy, it excels



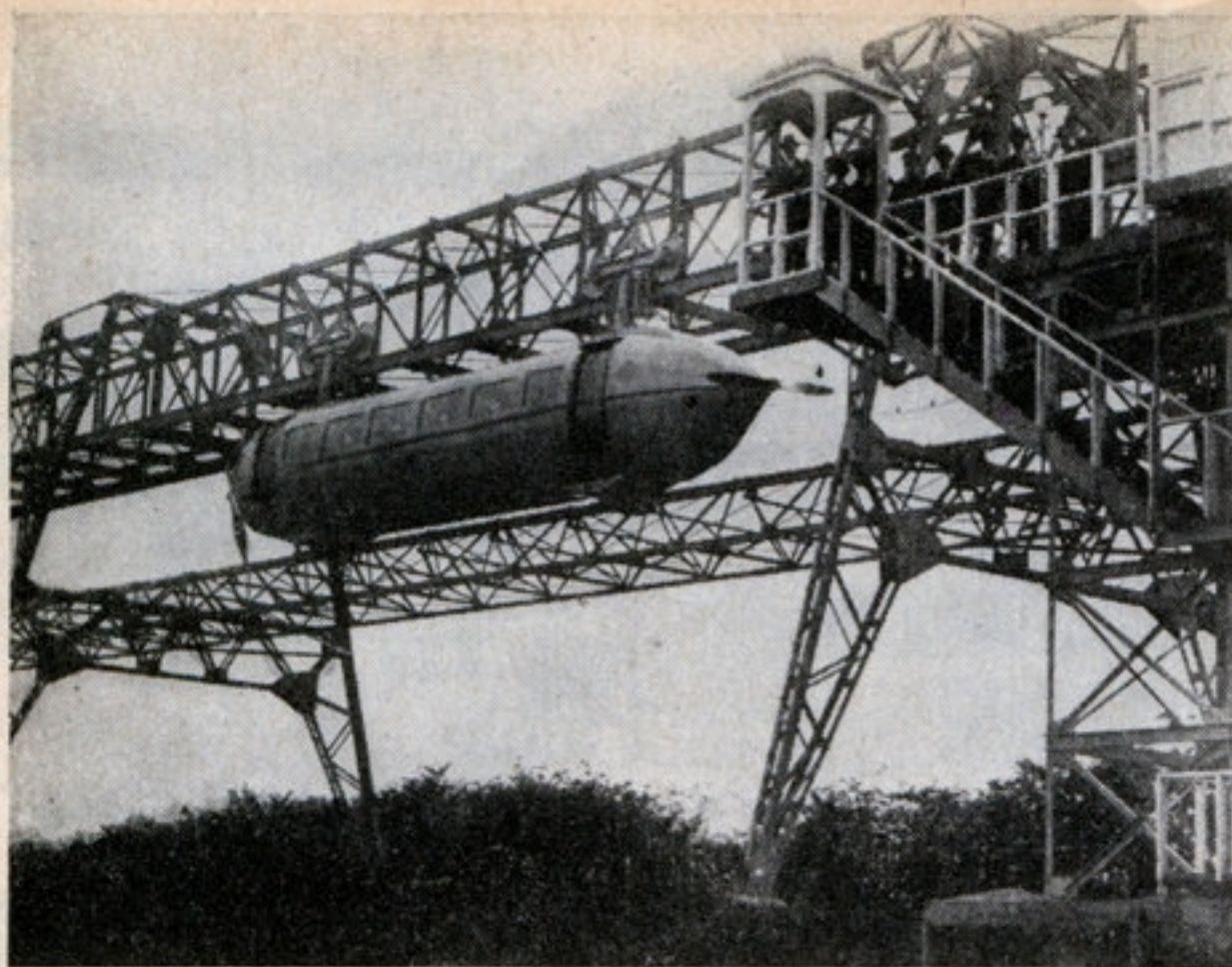


Ewing Galloway photo

A three-car train runs between Elberfeld and Bremen. With 20 station stops, this monorail travels more than 8 miles in 30 minutes. The capacity of one car is 75 passengers. City bus lines can't do as well.



This is how our artist believes monorail would look here. A truly streamlined train races past a small town. There are no grade crossings where pedestrians and motorists may be trapped.



Scotland uses monorail now. This bomb-shaped car supplies rapid transportation at Glasgow.

Why, if all these things are true, hasn't Monorail been introduced into America long ago?

That's easily answered. Surface line operators—both steam and electric—have thousands of miles of track crisscrossing the country, and tens of thousands of cars and locomotives. That represents a large investment. Rail executives have been too busy with the constant headache of keeping their systems in operation to think about another transportation "invasion," considered dan-

gerous to their investments. Motorcar makers have always frowned upon steam, or any other form of automotive power, for the same reason.

There is one answer. But conditions are now changed. The demands of war and the resulting overloading of all public carriers have worn out thousands of cars and countless miles of roadbed. To replace these items, billions of dollars will be required. So it is no secret that several big railroads and electric lines are looking to monorail as the single solution to the costly dilemma facing them.

Famous engineers, industrialists and financiers all over the world visualize the widespread use of monorail systems within a few years. Zara Witkin, consulting engineer to the Soviet Union government construction trust, and engineer of the United States government records, says: "Monorail meets all traffic needs, clears the streets, eliminates danger and can be erected in less time and at less cost."

It is proposed that the first line be built in

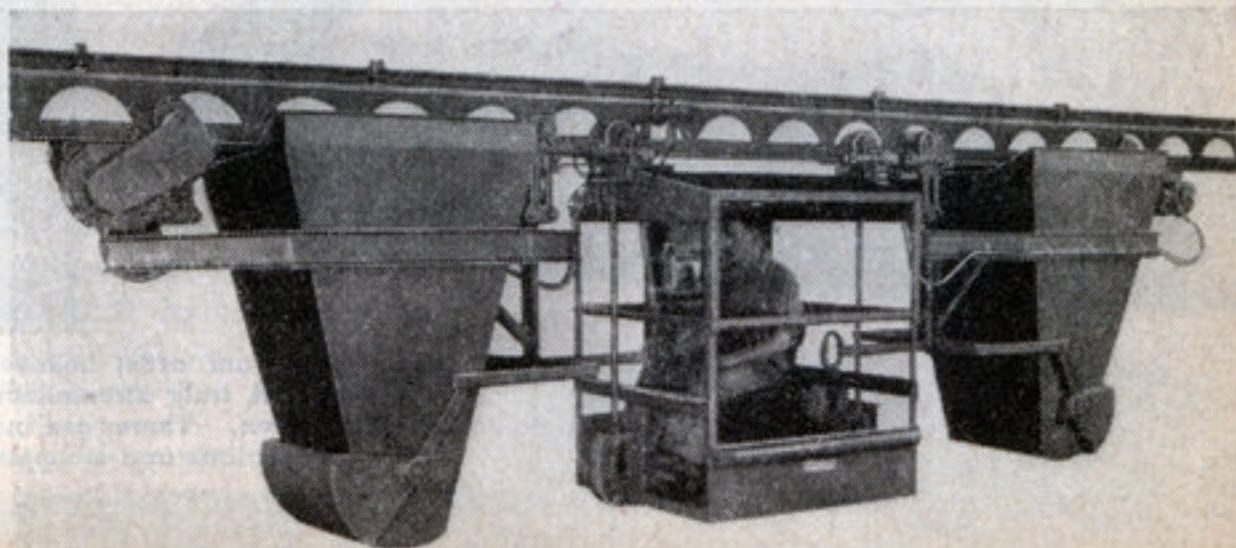
tically an antique, yet it has carried over more than a half billion passengers at speeds up to 125 miles an hour without a single fatal accident to anyone. It holds the finest service and income record of any transportation system in existence.

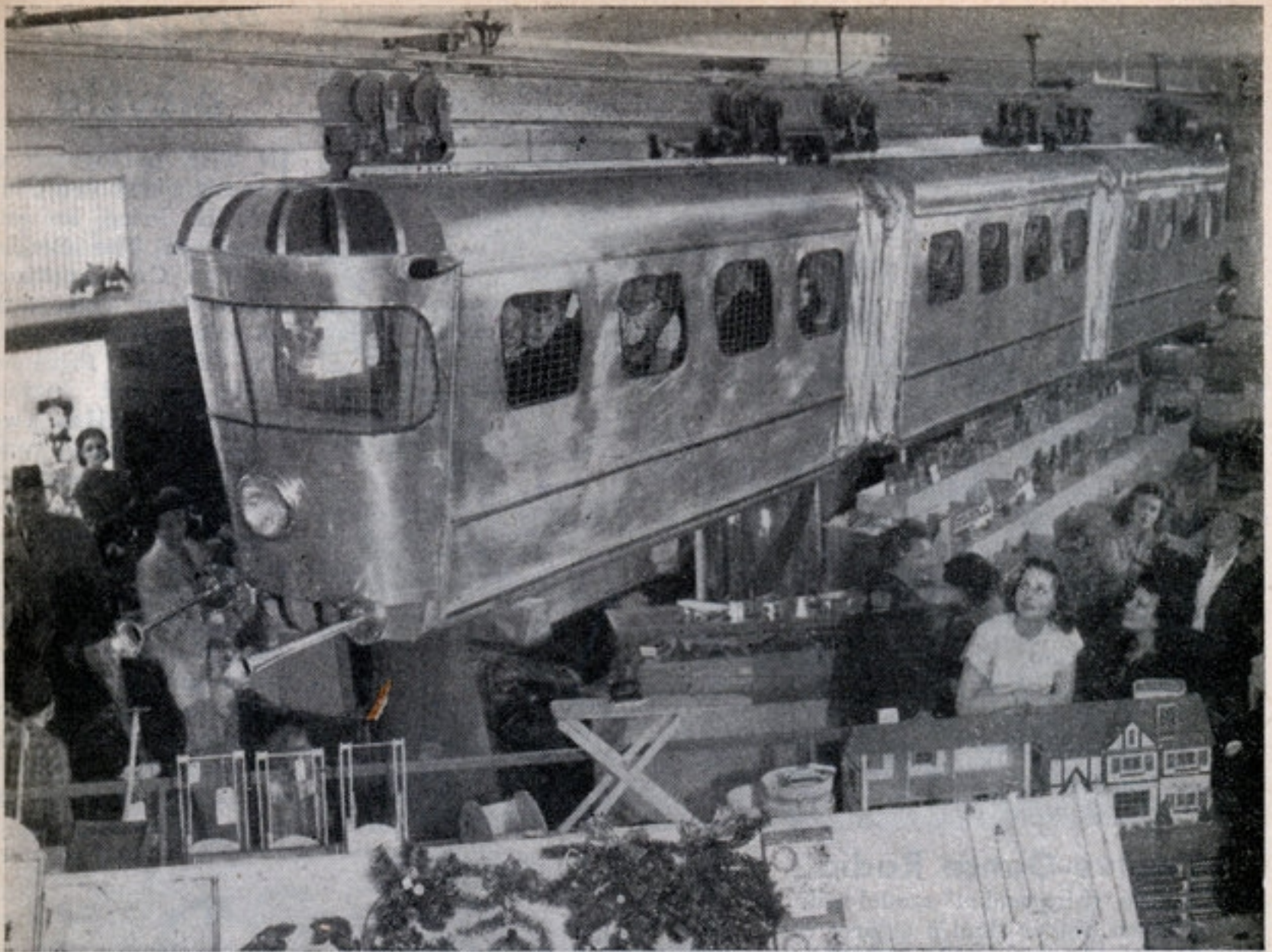
Many who have ridden on this line give assurance that there is positively no jar or vibration at any speed, and that it is almost impossible to tell when the train speeds around a curve, since its suspension, allowing free pendulum movement of cars, permits automatic banking on turns.

Monorail cars literally "fly through the air" above surface traffic. Cross-streets, peak hour crowds, snow, rain, fog—none of these things presents an obstacle to monorail. You must either bore through the earth or move above it to escape slow-moving surface traffic.

We now have two existing methods of grade separation—subways and elevateds. Subways cost from 3 to 11 million dollars a bore mile, and L's from \$866,000 to \$1,118,000 a single track mile, and these costs do not include rolling stock, stations or other equipment. Compare those costs with the highest estimate for Monorail—\$280,000 a mile, including all rolling stock, car barns and stations.

Here in America monorail is already in use. A motor driven, cab operated double bucket carrier has been developed by the Cleveland Crane & Engineering Company.





In a Milwaukee department store at Christmas time, children toured the toy counters in a miniature monorail train. They saw everything—and eased the holiday traffic jam.

California, between Los Angeles and Long Beach—a distance of 30 miles through some of the heaviest traffic in America. Unless you fly it today, you'll spend a full hour making the trip. Monorail will do it in 15 minutes!

We're going to build a transcontinental line, too, engineers say. At an estimated cost of about 800 million dollars a monorail can be built utilizing the right-of-way of the Southern Pacific and Illinois Central Lines. This line will touch most of the important cities across the country, and bring the coasts within 10 hours of each other—at a transportation cost of less than one-fourth of air transport rates!

Monorail is noiseless in operation because its drive wheels have no flanges and there is no side-thrust—the two unavoidable features that cause the clatter and jolting of surface rail cars.

The safety factors of monorail are not approached in any other vehicle. Surface trains can jump the track, collide with other trains, and run through open switches. Monorail cannot be derailed, according to its backers. A block signal and braking system, controlled by electronics, are said to make collisions impossible.

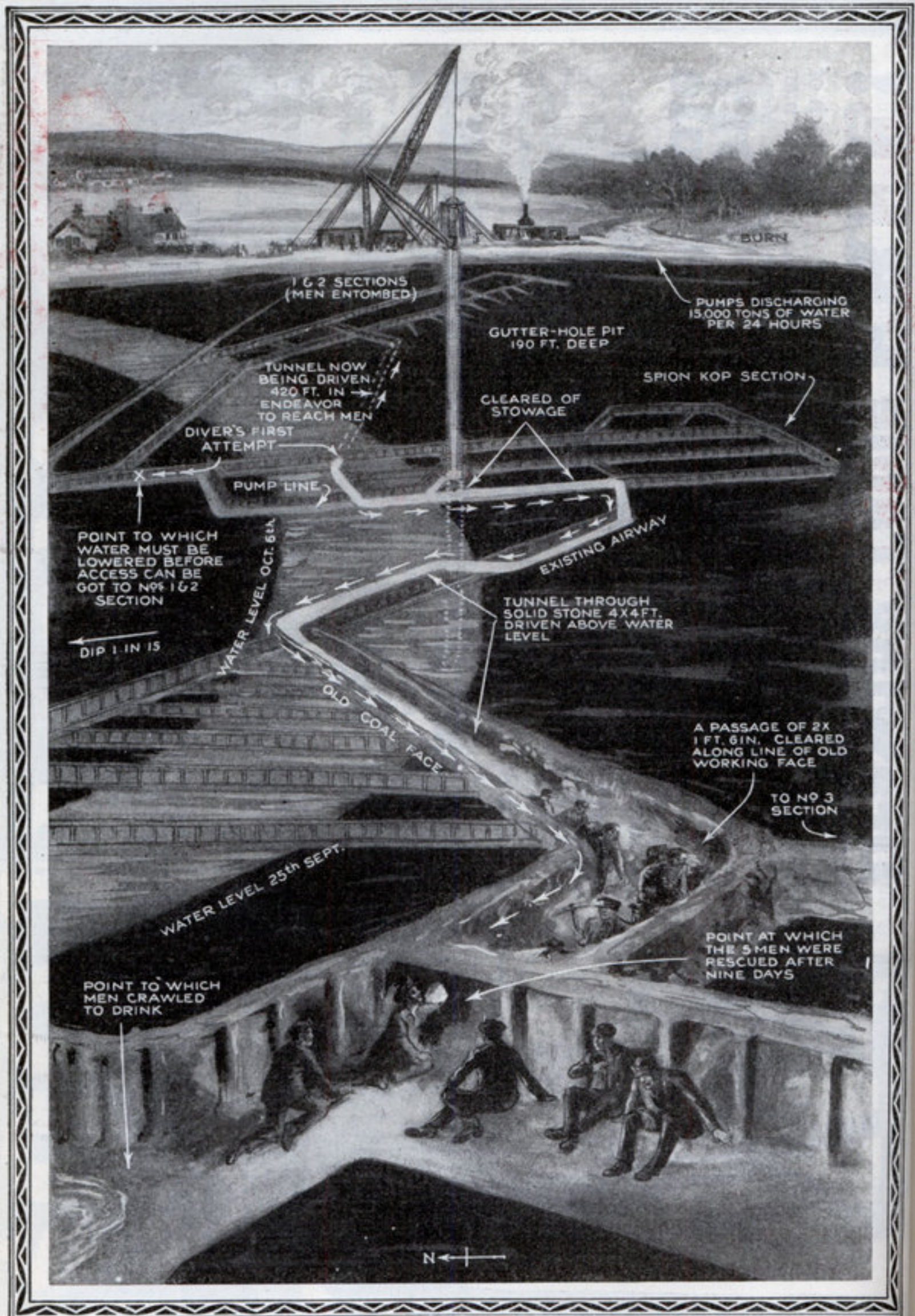
Monorail becomes the first dimension in the decentralization of the cities of the future. It means more than that. A rapid transportation system to outlying districts would bring about the sale of real estate now lying dormant, which

in turn would bring about an improvement in the morale of householders and create a property owner and taxpayer out of many a transient tenant.

From the standpoint of public benefit, monorail is at the top. A cursory survey covering all the cities of the United States with a population of more than 100,000 inhabitants, indicates a potential demand for 7,390 monorail cars. This is based on one car for each 10,000 inhabitants. At an estimated cost of \$20,000 a car, this represents 147 million dollars in the car-building business alone!

Assuming that four miles of twin track will be required for each car, a total of 29,560 miles of track will be needed. At a cost of \$280,000 a mile, we reach the astonishing figure of \$8,276,800,000—a vast number of manhours in any employer's language!

Monorail is not expected to jeopardize the financial position of any existing surface transportation system. It is public knowledge that before the war almost every urban transit line was operating at a loss. Now they have to spend millions repairing roadbeds and worn-out equipment. Present urban lines can be used for short hauls and as feeder lines to the monorail stations, which will speed up traffic, help to reduce accidents and expedite the progress of fire and police apparatus, backers of the scheme assert.



Rescuing the Five Men Imprisoned by a Scottish Mine Disaster Required Nine Days of Valiant Work. Divers Attempted to Penetrate the Wall of Water Surrounding the Victims. [Courtesy The Sphere, Copyright]



The NEW ERA of RAILROADING

LINES of light illumine the aisles of the "City of Los Angeles," and corner lamps in each berth focus bullets of light over your shoulder.



LUNCHEON on the transcontinental streamliners is served on a tray that folds into the seat ahead.

PART II

IT took ninety years to start the revolution that set the streamline train on its time-shattering career. You knew that revolution had come when you read that the fiery old iron horse had been stabled and in its place, trailing a string of coaches straight and smooth as an arrow's shaft, was no grimy black engine but a strange new power car of "cobalt and sarasota blue, golden olive and pimperl scarlet." Like an arrow the streamliner shot across the country, caught the public imagination, beckoned a new generation that thought the railways outmoded and slow to come for a thrilling hundred-mile-an-hour ride in this aluminum bullet.

A new era in railroading was beginning, yet its seeds were buried ninety years ago. For the streamline train was first prophetically suggested in a British patent granted in 1846 to Sir Henry Bessemer, inventor of the Bessemer steel process. He proposed a "wedge form" for the piston carriage of "atmospheric railways," to "diminish atmospheric resistance and allow the carriage to move at higher velocities with less power. The wedge





WALLS of the "City of Los Angeles" slope inward toward the top, and there is a radio built in behind a metal grille at the end of the lounge car, above. Below, the "City of San Francisco" nears the Chicago terminal after its 2,261-mile sprint over mountains and prairies.



MORE like an intimate club room than a railway car, the rear end of the Alton railroad's "Abraham Lincoln" is an air-conditioned solarium.

form may be used both in the fore and hind parts of carriages or of trains, in addition to the closing of the intermediate spaces." In 1865, as the American Civil War closed, U. S. patent No. 49,227 was issued to S. R. Calthrop for a train designed to diminish wind resistance, but the train was never developed. At the turn of the century the "Windsplitter," America's first streamline train, was given trial on the Baltimore & Ohio tracks in Maryland. It was designed by F. U. Adams of Chicago, a newspaper man. It never was placed in scheduled service, and the streamline idea slumbered on.

The epoch of the streamliner was born, at last, of necessity. In 1920 the railroads carried a peak-year load of 1,235,-

000,000 passengers. In 1933 only 433,000,000 passengers chose the rails for their thoroughfare. Passenger-miles dwindled from forty-seven billion in 1920 to a little more than sixteen billion in 1933. What drastic, dramatic gesture could lure back the lost passengers to the railways?

The streamliner was the answer. Dramatic "packaging" for the traveler. Mighty power plants wrapped in color—"sarasota blue and pimperl scarlet," for one—that would draw thousands every day to watch them roar by, and would pile up a waiting list of passengers.

The railroads borrowed style from giant air transports and from streamline automobiles. But speed called for more



LUNCH counter service is an innovation on the "Abraham Lincoln." Here the Chicago-St. Louis passenger is served quickly at reasonable prices.

than mere styling, and the railroads went to the automotive manufacturers for an engine that would haul million-pound trains—built at a cost of a dollar a pound—across the continent day after day at eighty and ninety mile speeds without breakdown. Speed was nothing new to the old iron horse, for a record of 127.1 miles per hour marked up by the Pennsylvania's Broadway Limited in 1905 has yet to be challenged by today's fast trains. Even today the Chicago and North Western's conventional steam "400" matches the better than mile-a-minute pace of the streamline steam "Hiawatha" and the Diesel-electric "Zephyr" between Chicago and St. Paul. But sustained speed, a thousand miles nightly from Chicago to Denver,

two-thousand-mile sprints from Lake Michigan to the Pacific, called for an engine with long-distance stamina, and the Diesel was given the assignment.

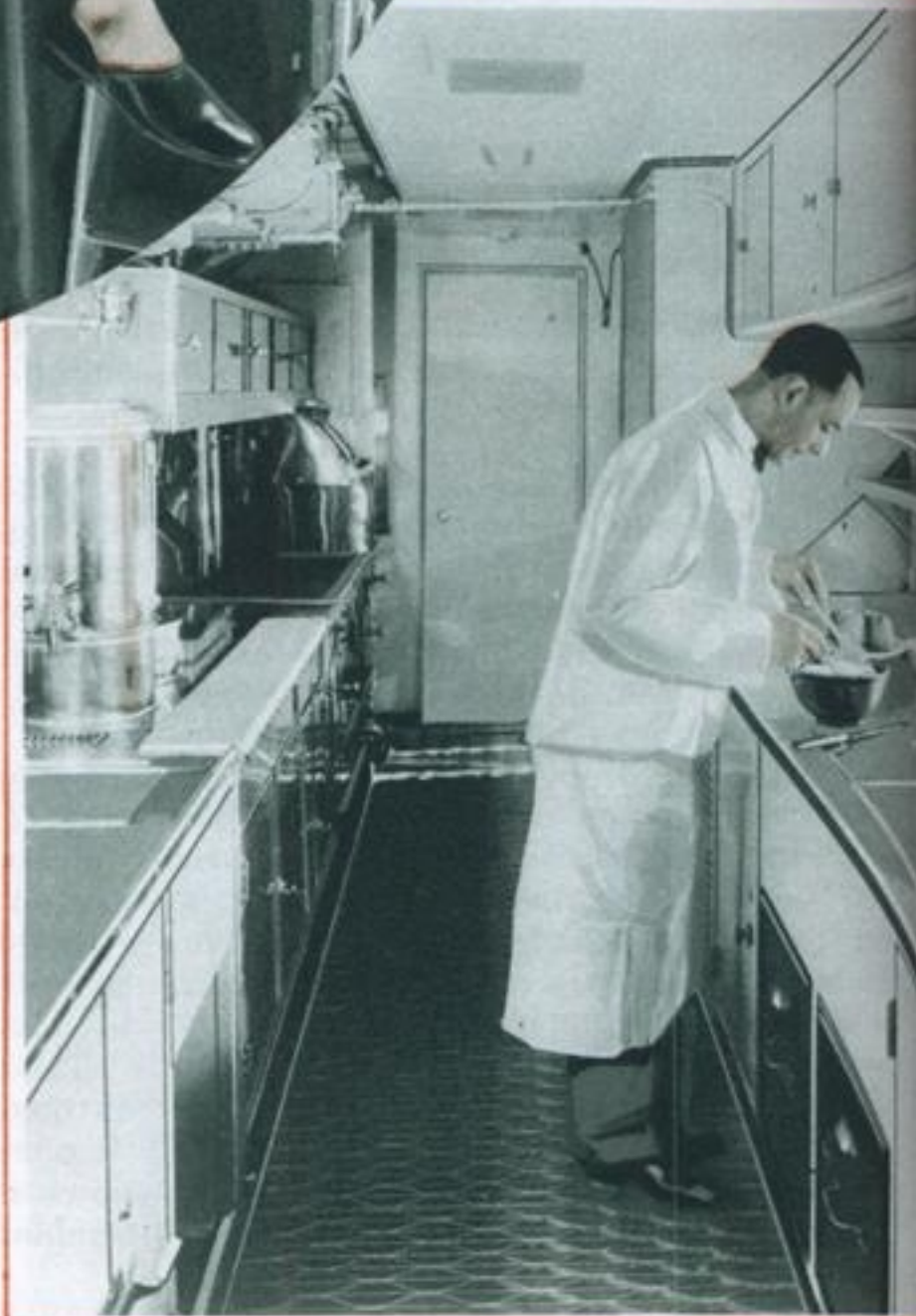
Climb into the massive yellow power car of the "City of San Francisco," one of the newest and most powerful of the growing fleet, and watch the engineer start his eleven-car streamliner on its journey of two nights and a day to the bay city from Chicago. Half-way across Nebraska this speedster will overtake the steam train that left Chicago eight hours in advance.

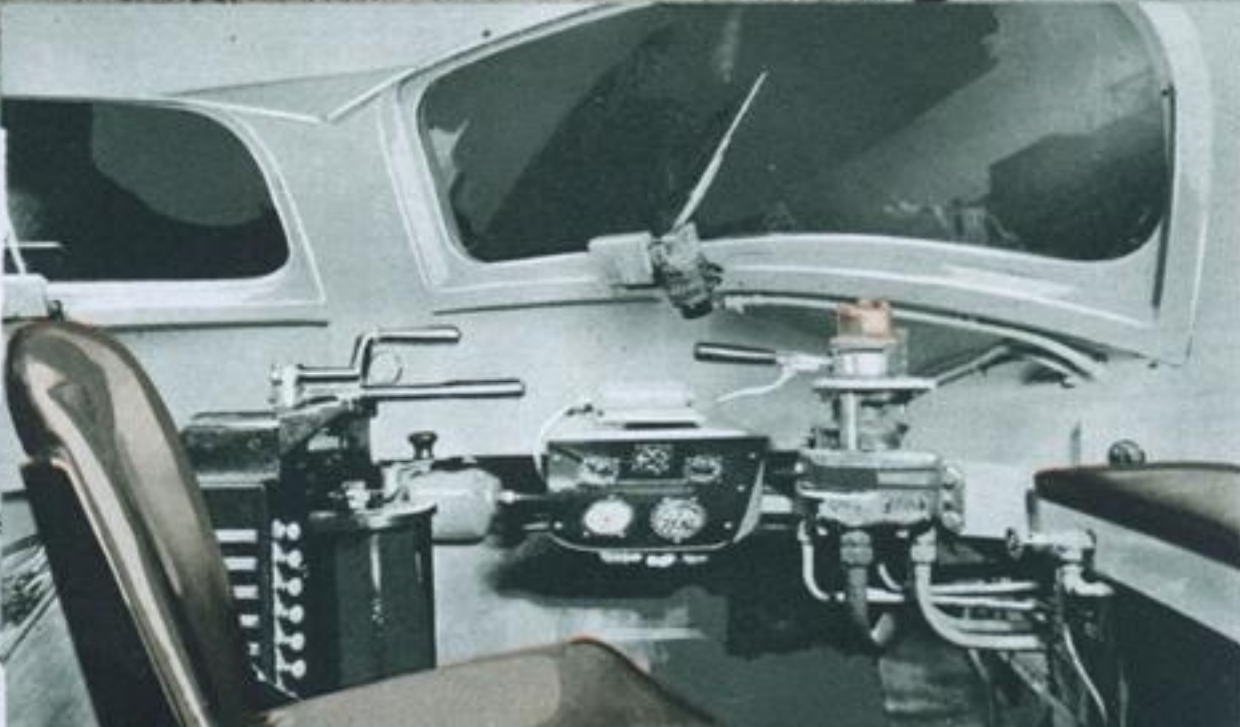
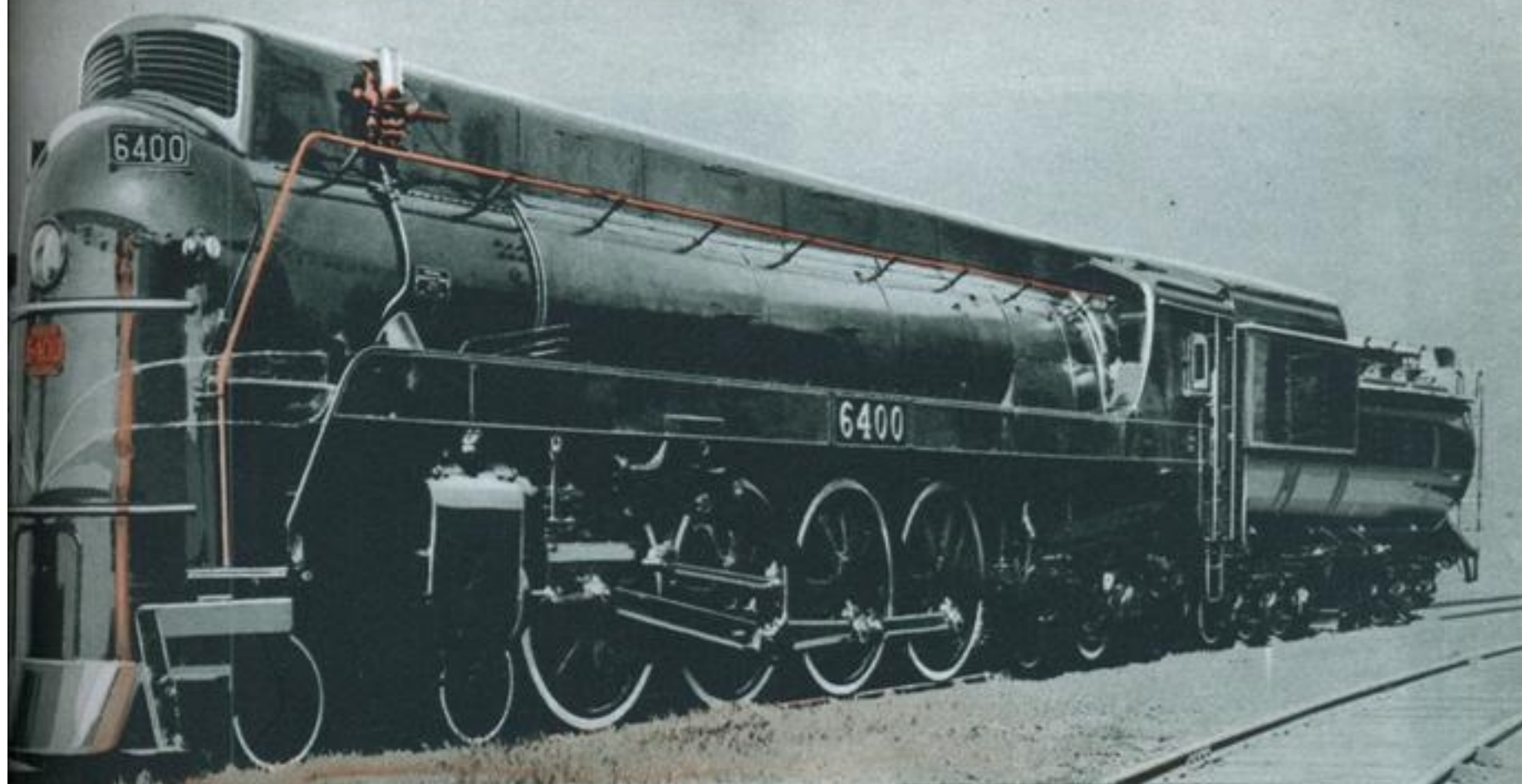
The Diesel-electric engineer is half automobilist, half electric motorman. His "fireman"—an obsolete term—climbs down into the grey power room that resembles the engine room of a great ship,

WINDOWS make upper berths of the California-Chicago streamliners attractive, and there are folding steps instead of ladders. Below, the chef on a speed train mixes a salad bowl.



starts the Diesels as you would start an automobile engine, and rejoins the engineer in the cab. Three auxiliary motors have already been running, furnishing power for lights, air-conditioner, brake lines. Given the "highball," the engineer releases his brakes, sets the motor in "series" and advances the controller to "Speed 2." The mighty locomotive starts forward almost imperceptibly—a jolt is all but impossible with articulated, shockproof coupling—the controller is advanced again and the purr of the Diesels becomes a roar as





CANADA'S first streamline engine, top, a giant steam locomotive hauling crack passenger trains of the Canadian National railroad. Center, a view of the controls in the cab of a Diesel-electric power car, and below, the Milwaukee road's "Hiawatha" putting on its spectacular daily show between Chicago and St. Paul.



FRONTIER days are remembered in this unique room on the "City of Denver." With its pine walls decorated with old photographs and posters, it is reminiscent of the pioneer west.

the electric drive draws more and more power. When the train reaches a speed of thirty miles an hour the controller is thrown back, as if to shift gears; the motor is switched from "series" to "parallel" and again the controller moves forward. There are eight speeds on the controller. At sixty miles an hour the engineer switches beyond "parallel" into the high cruising range, and the streamliner hits its stride.

Like an automobile, the Diesel is watercooled and the crew must keep its

temperature around 160 degrees. Dials in the cab show the engine temperature, train speed, and air-brake pressure. There are warning lights to indicate overheated motor and low lubricating oil. Instead of semaphore signals, the automatic train control flashes a light in front of the engineer if the track ahead is obstructed, and if he fails to reduce speed in acknowledgment of the warning, the train is automatically brought to a stop. Temperature of the motors can

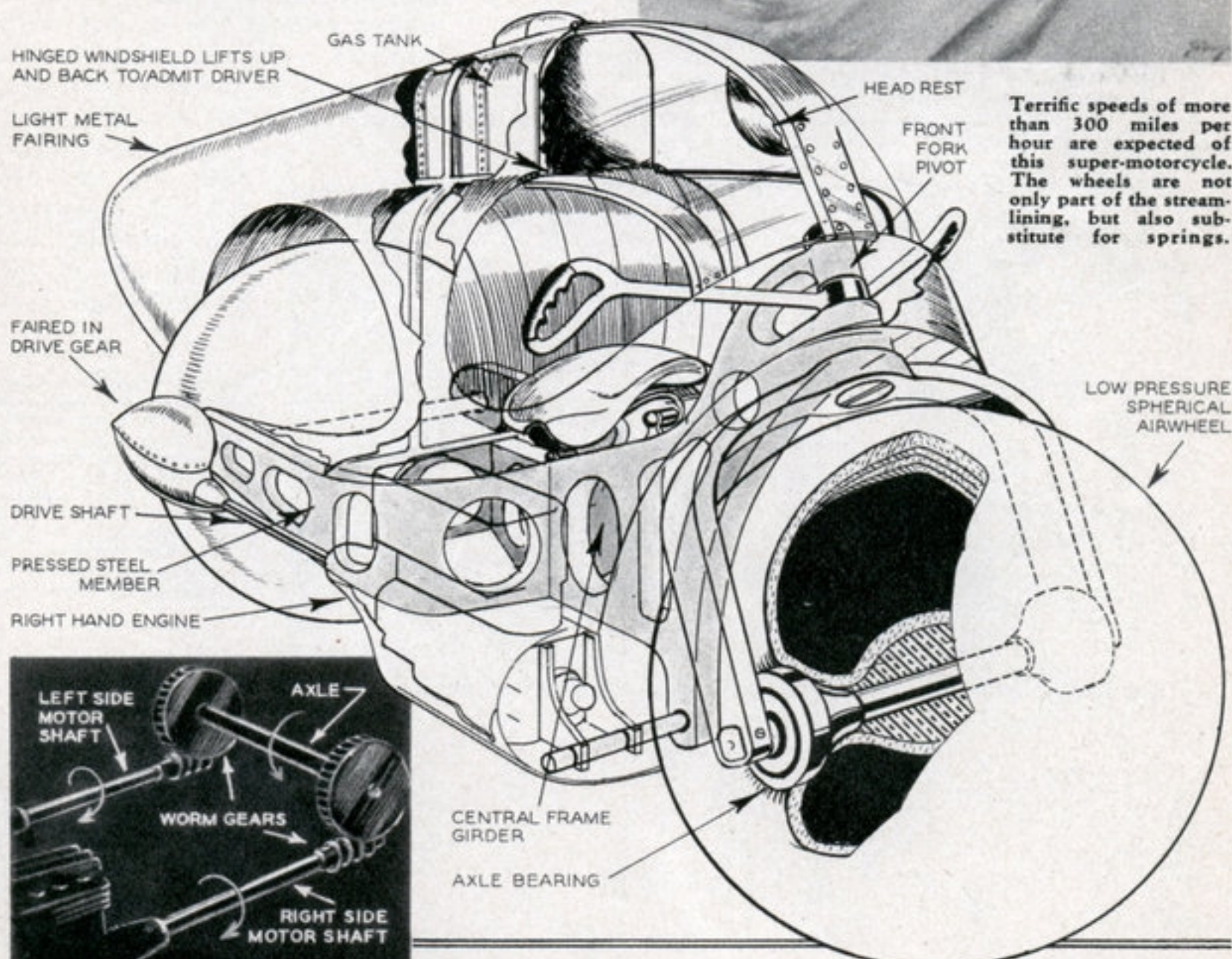
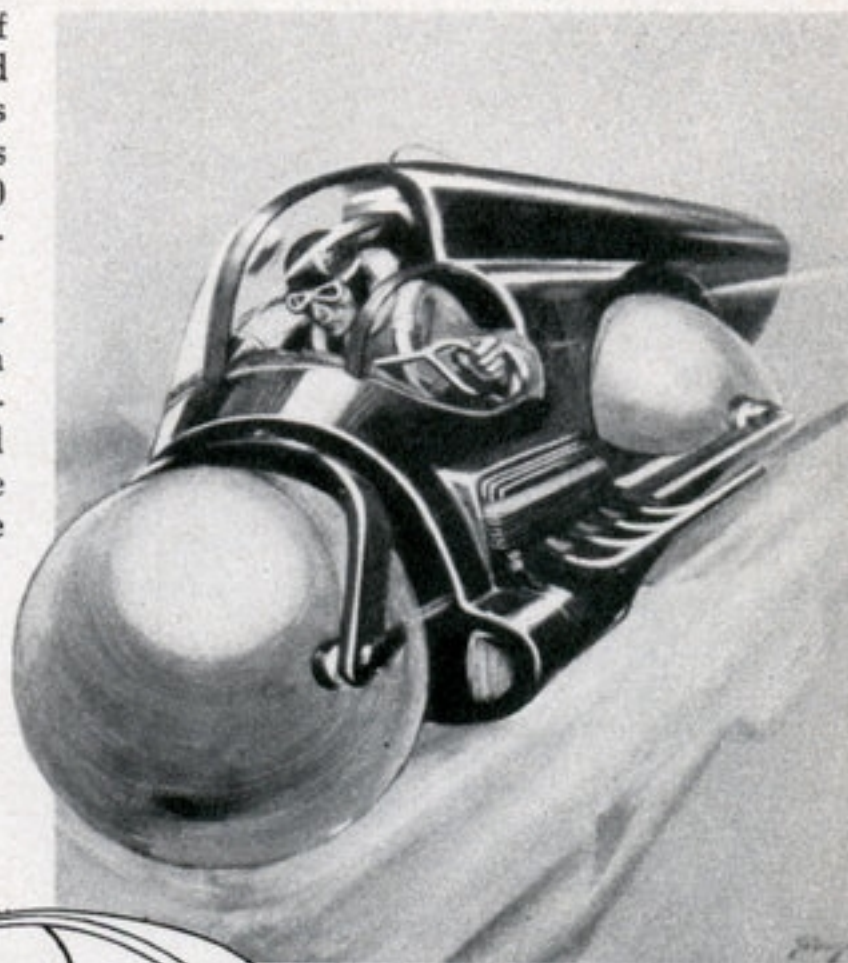
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Super-Cycle to Smash All Speed Records

MOUNTED on spherical airwheels of moderate pressure, a recently designed super-motorcycle powered with twin motors is expected to shatter all existing speed marks for land vehicles. Speeds of more than 300 miles per hour will be reached without difficulty, its designer believes.

The driver is encased in a partially faired-in cabin and is securely strapped down in his seat. A headrest over the windshield provides additional bracing. Steering is effected in the customary manner. Two separate power plants are employed, one on each side of the powerful rigid chassis. The drive is carried to the rear globular wheel by means of conventional shafts and gearing.

The peculiar wheels, apart from providing greater traction and serving as shock-absorbers, are expected to add to the streamline possibilities and the stability of the machine.

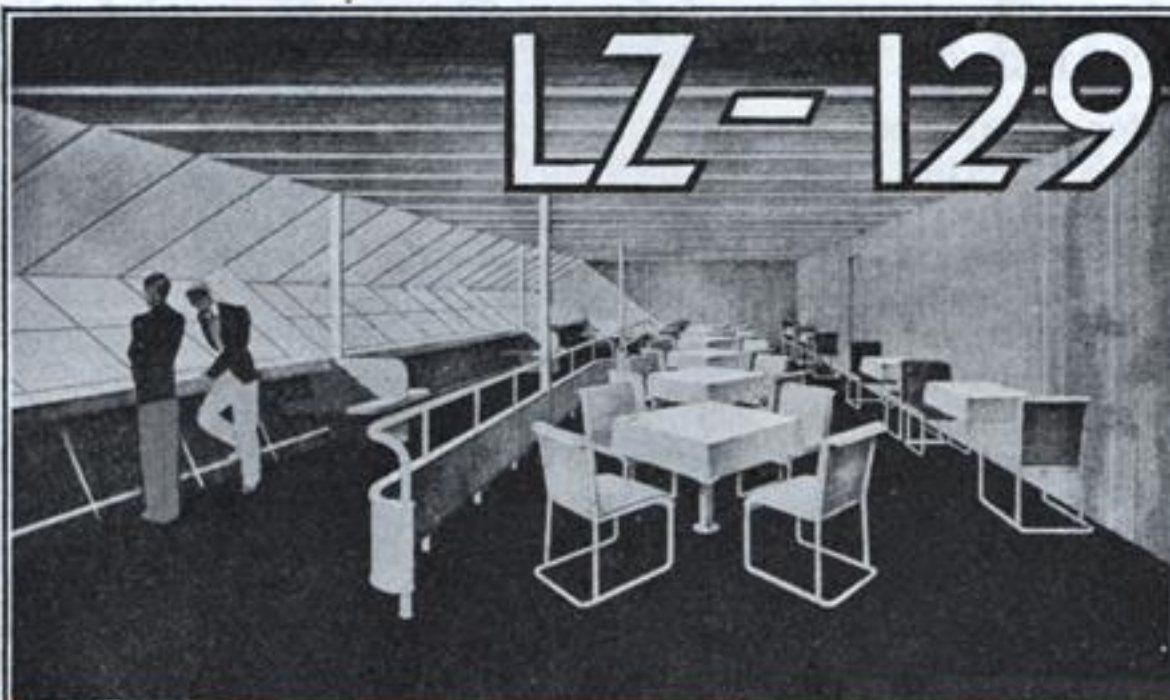


Terrific speeds of more than 300 miles per hour are expected of this super-motorcycle. The wheels are not only part of the streamlining, but also substitute for springs.

A phantom drawing, showing operating principles of the super-motorcycle. Twin motors supply the power, one being mounted on each side of the machine as shown in the detail at left. The low pressure tires replace springs and shock absorbers.

LZ-129

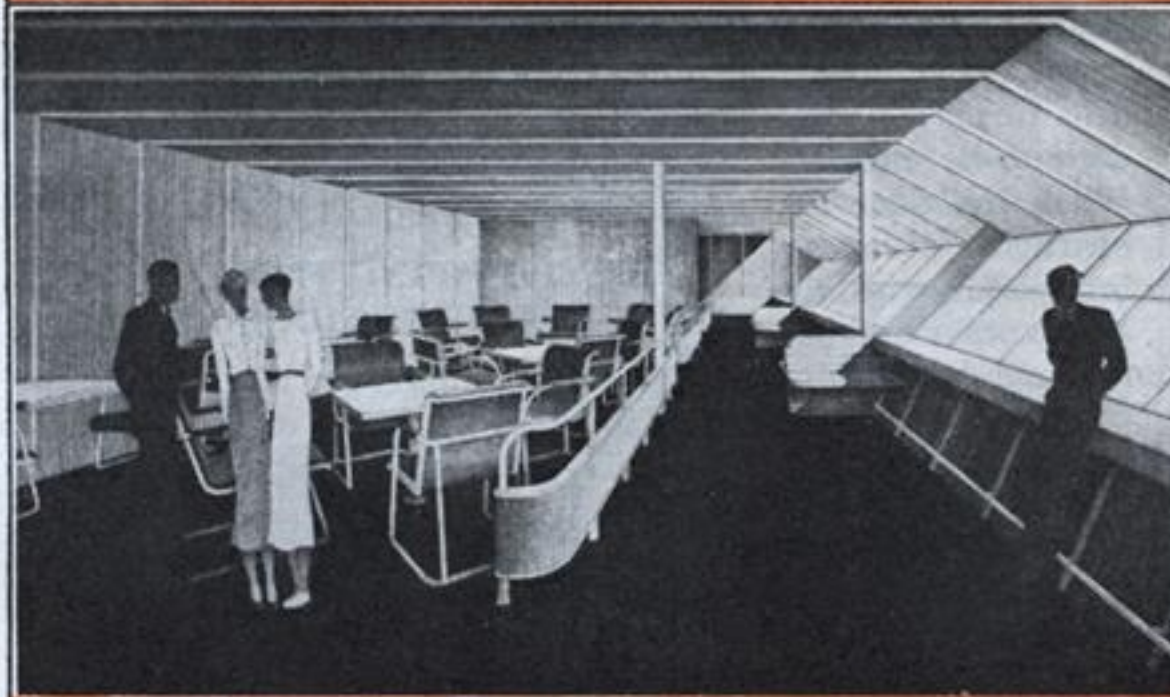
The



Promenade Deck of the New German Dirigible, and Dining Room Designed by Prof. F. A. Breuhaus, Berlin Architect; Note the Slanting Windows Which Give Passengers a View of the Panorama Below



One of the Lounge Rooms of the Dirigible Where Passengers Assemble for Social Gatherings; Note the Light but Sturdy Metal Furniture Designed Especially for the Dirigible



This Is One of the Promenades and Lounging Rooms of the Giant Airship Which Has Accommodations for Fifty Passengers and a Crew of Thirty-Five Persons

Latest AIRSHIP



DR. HUGO ECKENER'S latest venture with rigid airships promises to unfold endless possibilities of traveling safely and swiftly through the air in modern luxury.

The "LZ-129," under construction since February, 1932, is about to make her maiden trip across the Atlantic, with Dr. Eckener as her master.

Here are the main facts about the ship: Length, 812 feet; greatest diameter, 137 feet; gross lifting capacity, 418,000 pounds; pay load twenty-five to thirty tons; fuel load, 130,000 pounds; cruising speed eighty miles per hour, which will carry it across the Atlantic in about two days.

Passenger accommodations are superior to those on any previous aircraft. The designer, Prof. F. A. Breuhaus, created an "architecture of the air" in the interior decoration. He designed chairs, tables and beds as an engineer would design a bridge.

Because so much dead weight was saved

Diagram of Passengers' Quarters, Showing Dining Room, Lounge and Cabins in Center

in the design, it is possible to accommodate fifty passengers and a crew of thirty-five in the ship's twenty-five staterooms, each with hot and cold running water. In addition, the ship will carry considerable express and mail.

There are two groups of parlors, including two promenade decks, giving a total floor space of 5,380 square feet, of which one-half is available for social gatherings.

The passengers will be permitted to smoke, a luxury denied on the "Graf Zeppelin." The social salons and promenades

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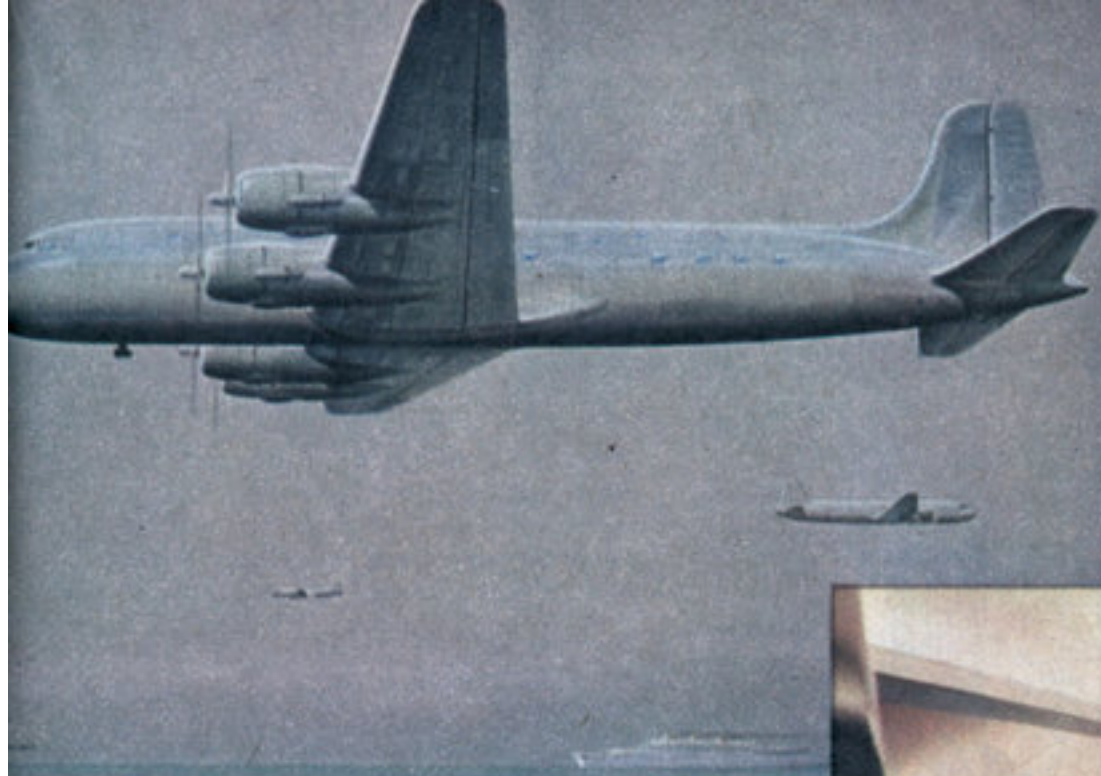
SUPERLINERS FOR WORLD

NEW commercial transport planes, shrinking the United States to 1/200 the size of a century ago in terms of time, are incorporating a brand-new concept of comfort for the passenger. When airliners began operations in the late 1920s, the mechanics of operation were a primary consideration with designer and air-carrier

companies. Today cushion-rubber chairs, modernistic lounges, and temperature controls are deemed as important as the navigational devices up front. To those are added speed; transcontinental flight in the Lockheed Constellation, for instance, is a matter of 10 hours, and crossing the Atlantic Ocean between Washington, D. C., and



Double-decked Boeing Stratocruiser has made a record of slightly over six hours from Seattle to Washington, D. C. This comfortably upholstered airliner will carry up to 114 passengers or 39,000 pounds of cargo at speeds well over 300 m.p.h. Cabin is pressurized to the atmospheric equivalent of a 6,000-foot level.



Up to 70 passengers will be carried by day in the Douglas DC-6 (left), while at night the capacity will be 26. Speed and comfort are stressed.

In Convair's Model 110 (below), Henry Dreyfuss has made good use of indirect lighting, polaroid windows, reclining chairs, in interior design.

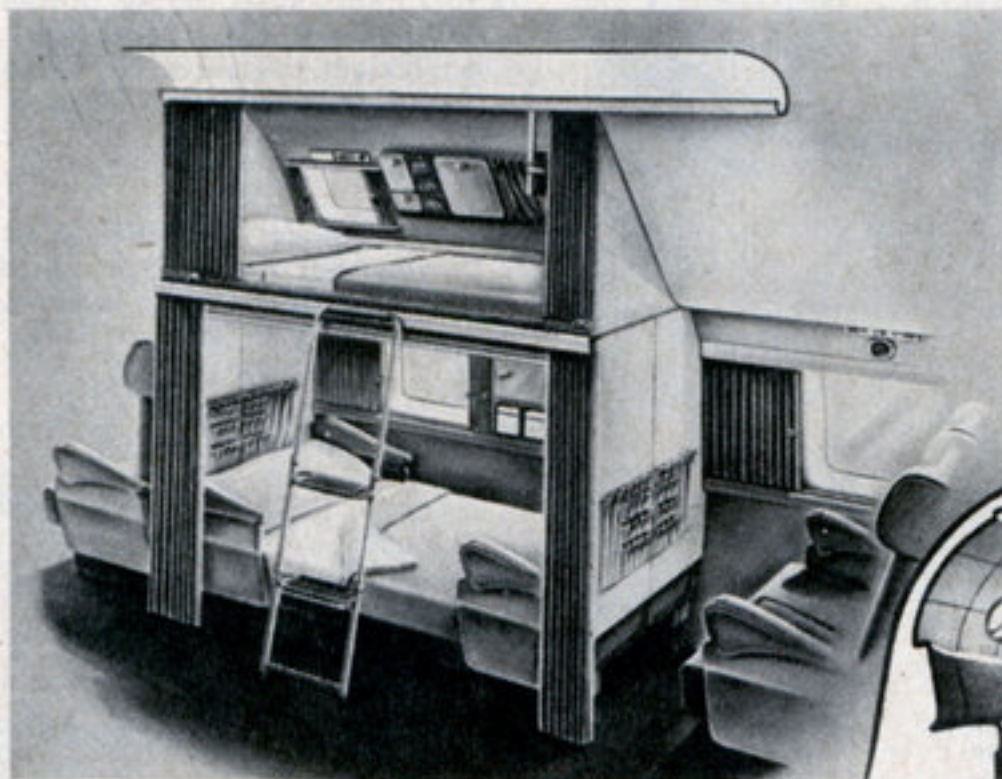
First postwar luxury air transport to enter service, the Constellation plies between coasts in 10 hours. Passengers getting aboard at New York after the theater reach Los Angeles for a late breakfast.

SKYWAYS



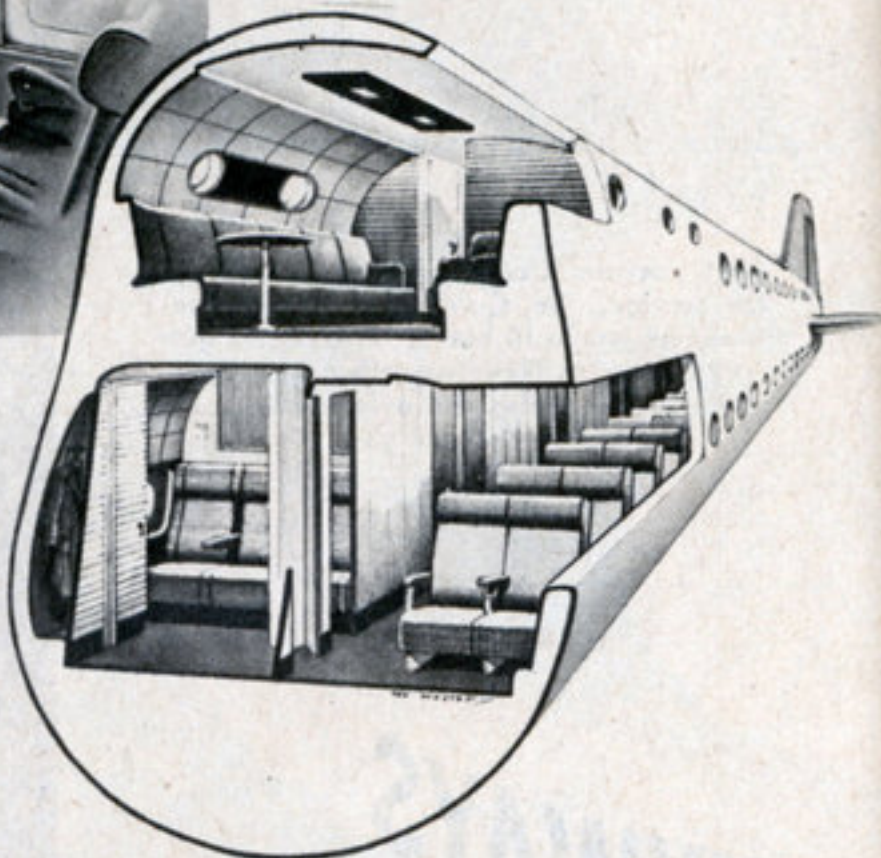
Here's the biggest airliner of the lot—Consolidated Vultee's Model 37. Weighing 320,000 pounds, it will be nearly twice as heavy as any land plane yet flown. Six gas-turbine engines will drive the giant.





Each berth of the DC-6 has an outside window. Lower is 76 inches long, uppers 78 inches, both about 40 inches wide. Bedding and end panels are stored in upper berth.

A cross section of proposed Pan American Clipper, showing the interior of the 204-passenger transport. Upper deck has lounge and rest rooms, lower has staterooms.



Paris, France, takes less than 13 hours. Designers and engineers are preparing other titans to speed the new era of air travel—Douglas' DC-6, the huge Stratocruiser by Boeing, and the gigantic Model 37, by Consolidated Vultee. Soon a passenger may breakfast in London, enjoy a late lunch in New York, and go to bed that evening in Los Angeles.

Just what do these new giants offer?

Constellations carry 57 passengers more than twice as fast as the familiar veteran, the 180-mile-an-hour DC-3. The fuselage in cross section is a perfect circle. Two superchargers pour fresh air into the cabin to hold pressure at a simulated level of not more than 8,000 feet, and heating and refrigeration control the temperature. Circular windows enable passengers to enjoy



The greater space and comfort provided for Stratocruiser pilots inspired Ernest Norling, Boeing designer, to draw this conception of a flier's dream.

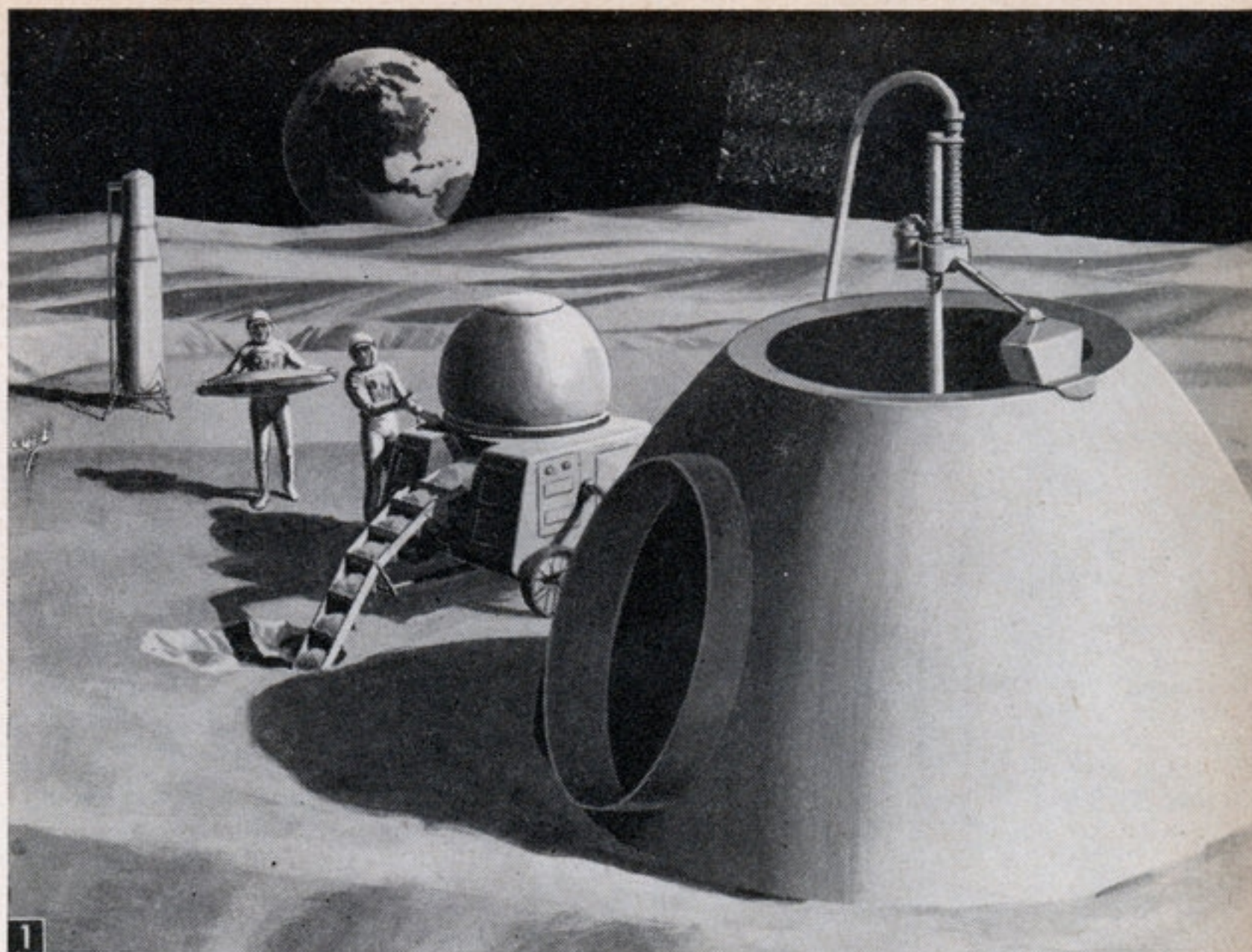
the unfolding view. More than 100 Constellations are being rushed to completion.

When the DC-6 makes its appearance, it will be 80 inches longer than the DC-4 and will cruise at about 275 m.p.h. Passengers will enter this plane through a door aft of the wings. They will relax in cushion-rubber chairs, and stewardesses will serve meals from buffets near the door.

The two decks of the Stratocruiser have been created by building one fuselage above the other. The bottom section is as wide as the Army's Superfortress. The upper is slightly larger.

Consolidated Vultee's Model 37, developing 30,000 horsepower, will have a cruising speed of 342 m.p.h. This monster will be nearly twice as heavy as any land plane yet flown. On nonstop flights up to 4,200 miles, 204 passengers will enjoy the comfort of four cabins on two decks.

These planes use plenty of gas. At take-off, the Model 37's six big engines will consume fuel faster than you could bail it out of a barrel with a 10-quart pail, but they develop more power than 360 Ford V-8 engines. The electrical system would supply a town of 5,000.



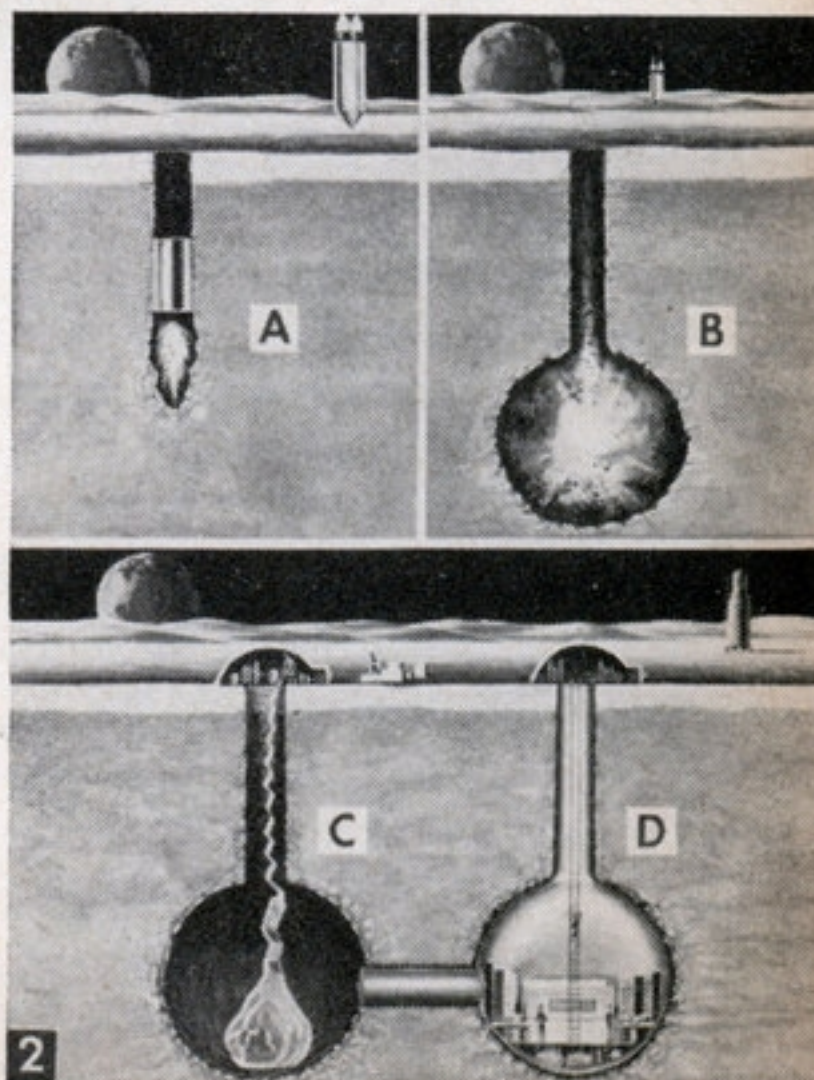
1

Astronauts would need to transport minimum material from Earth for this surface igloo. A binder would be mixed with lunar dust and rock for a kind of mortar. Alkali from Earth would combine with pumice from the Moon for a low-temperature glass to bind and harden the material.

Blast a Home in the Moon?

THE latest in a series of proposals for your lunar living facilities—in case you decide to make the trip—suggests construction could begin even before you land. A projectile from Earth would carry special shaped charges to blast a shaft (Fig. 2A) in the Moon's surface. At a predetermined depth it would blow a spherical chamber (2B).

When the construction crew lands, an airtight membrane would be dropped into the chamber (2C) and inflated, and equipment and supplies would be installed (2D). The finished Moon base would consist of a series of the pressurized chambers connected by tunnels. Surface structures would contain airlocks, according to the proposal made to the American Rocket Society by a researcher from General Electric's Missile and Space Vehicle Department, Philadelphia.



2

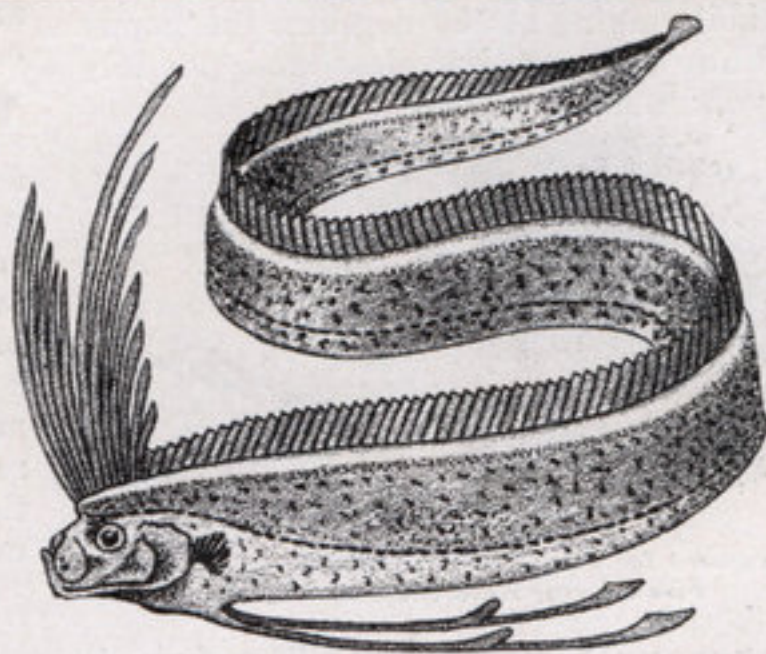
Artist's conception shows stages in construction of one possible Moon living facility.



Is there a

RECENT startling events have revived the ocean's greatest unsolved mystery—Is there a sea serpent? Startling apparitions have evoked an amazed reply of "Yes!", which downright fakes have turned to a wisecracking "No!" But best scientific opinion refuses to deny flatly, that somewhere, in the deepest depths of the ocean, there may be such a thing, a species unknown to modern science.

This possibility appears amazingly real in the light of the sensational tales of the last nine months that have made the sea serpent come alive again, after years of quiescence. For almost all these tales are told not by one person, but by hundreds. All vow they have seen marine monsters like nothing known, and in several different places. Nearly two hundred canny Scots have seen something that undoubtedly inhabits Loch Ness, inland lake in northern Scotland. In the Pacific ocean,



Above, the "Valhalla" and Drawing of a Creature as Observed from This Craft Off Brazil in 1905; Below, Oarfish, a Deep-Sea Dweller Which Some Believe May Have Been Mistaken for a Sea Serpent

near Vancouver, three score testify to having seen a sea monster. High officers of the liner, "Mauretania," wrote in the log book recently that they saw one in the Atlantic.

All descriptions of the sea serpent agree pretty well—a snake-like creature usually with coils protruding from the water

SEA SERPENT?



SEEN BY MISS JANET FRASER & TEN OTHER WITNESSES FROM
"HALF-WAY" TEA HOUSE, AULTSAY, SEPTEMBER 22ND, 1933, 11AM.
(FROM A DRAWING MADE UNDER HER SUPERVISION)



SIDE VIEW OF
HEAD.
SHINING SPOT.



HEAD TURNED
TOWARD
WITNESSES

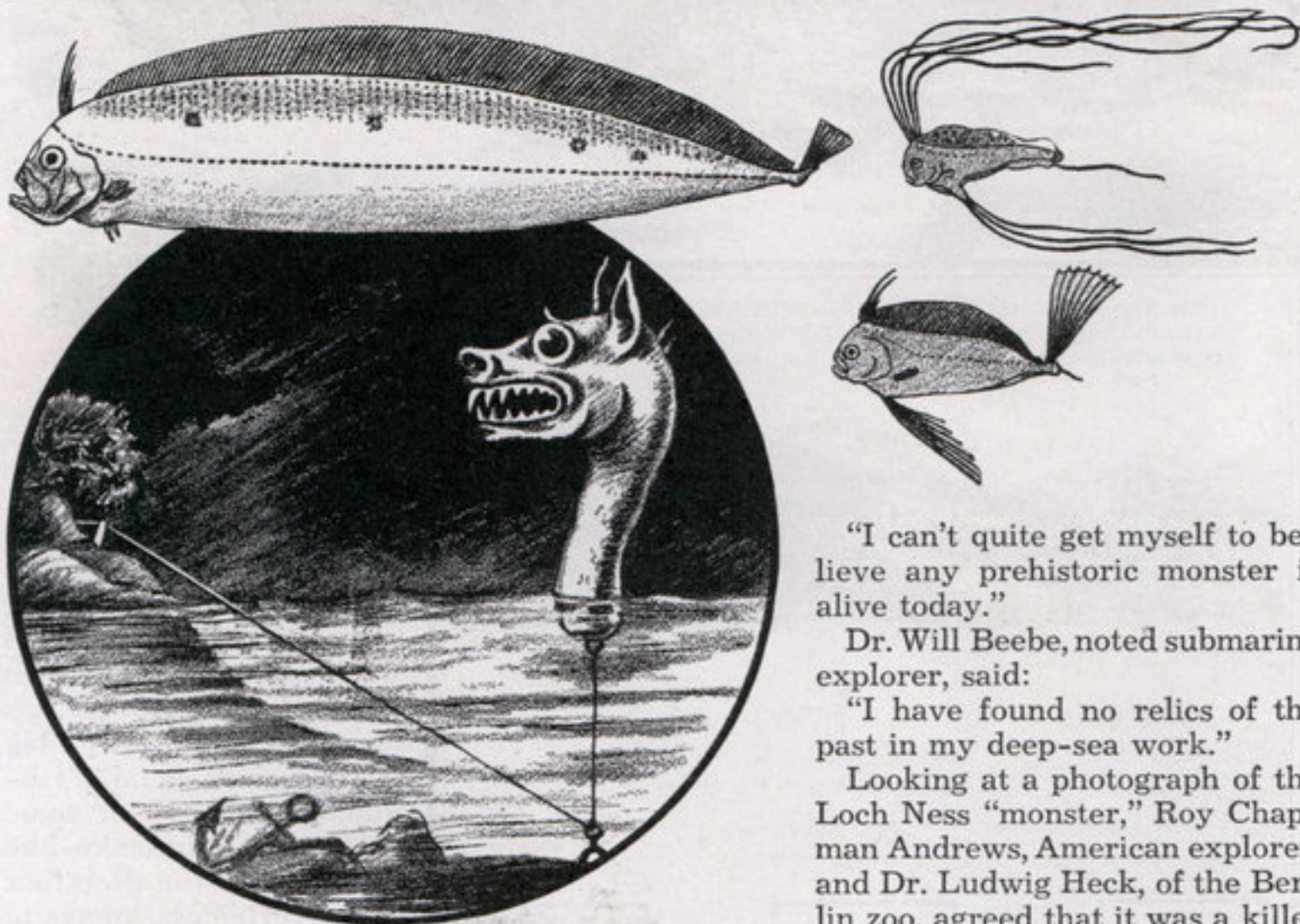
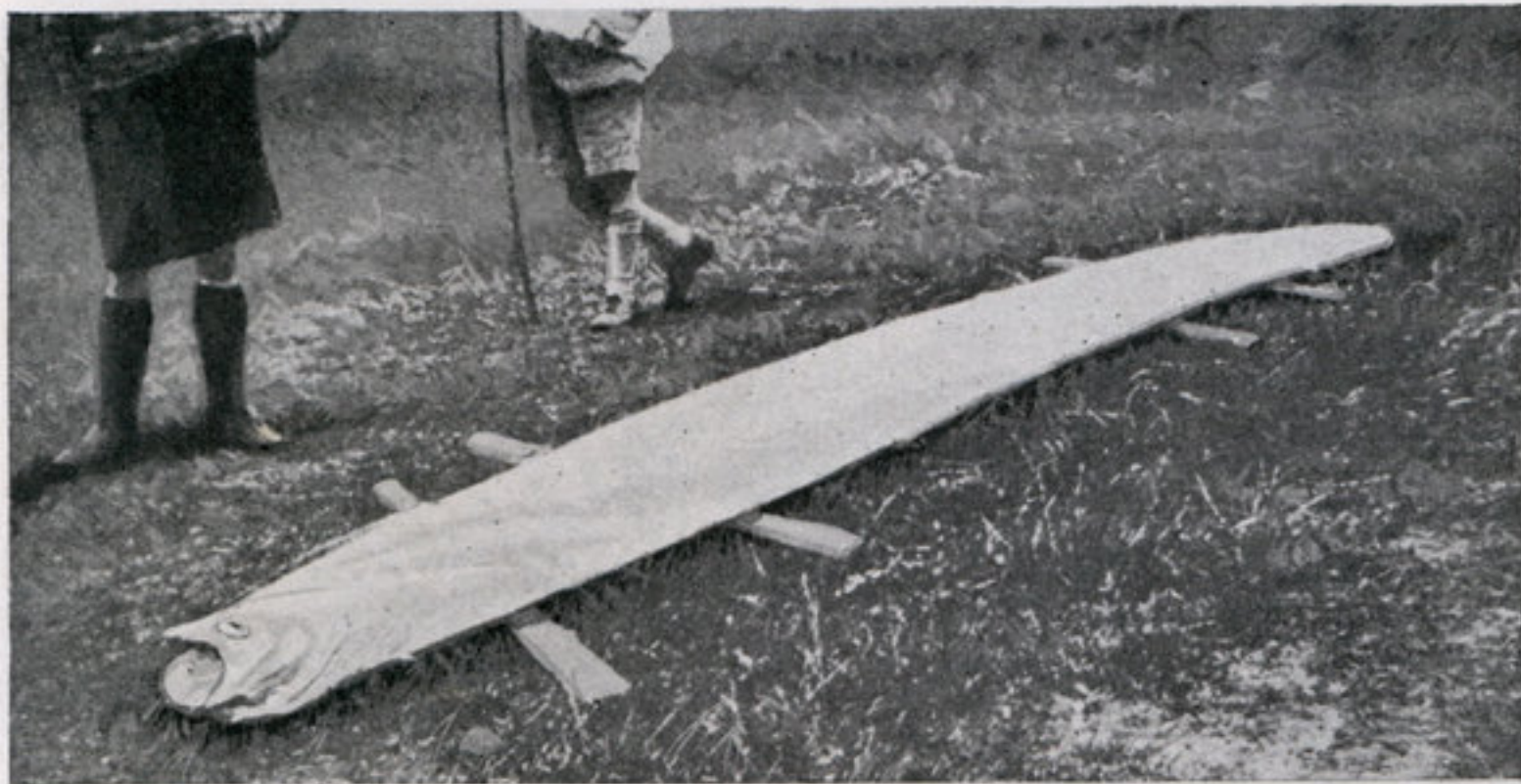


HEAD TURNED
AWAY



Drawing of Loch Ness "Monster" Made from a Description of Several Witnesses Who Observed the Shining Spot on the Head and Other Details

something like a caterpillar's humps, dorsal fins or flippers, perhaps webbed, and a small, snake-like head. Often the "serpent" has been proved to be porpoises swimming in a line, a big seal, a giant squid, a ribbon or oar fish or some other weird, snake-like creature of the deep that is, nevertheless, known to science. But many scientists, noting the similarity in the descriptions, admit there may be a rare, separate species. Or, more astounding, that some great reptiles of early days, dwelling in slimy submarine fastnesses,



Lower Drawing © New York Sun
Top, a Creature Landed Near Loch Ness, Believed to Be a Conger Eel; Center, Mature and Small Ribbon Fish, Related to the Oarfish; Bottom, Drawing Showing How the Fake "Sea Serpent" Which Frightened Summer Visitors at Lake George Was Operated

may have been brought by earthquake or other upheaval to the surface.

Raymond L. Ditmars, curator of reptiles at the New York zoo, says:

"I can't quite get myself to believe any prehistoric monster is alive today."

Dr. Will Beebe, noted submarine explorer, said:

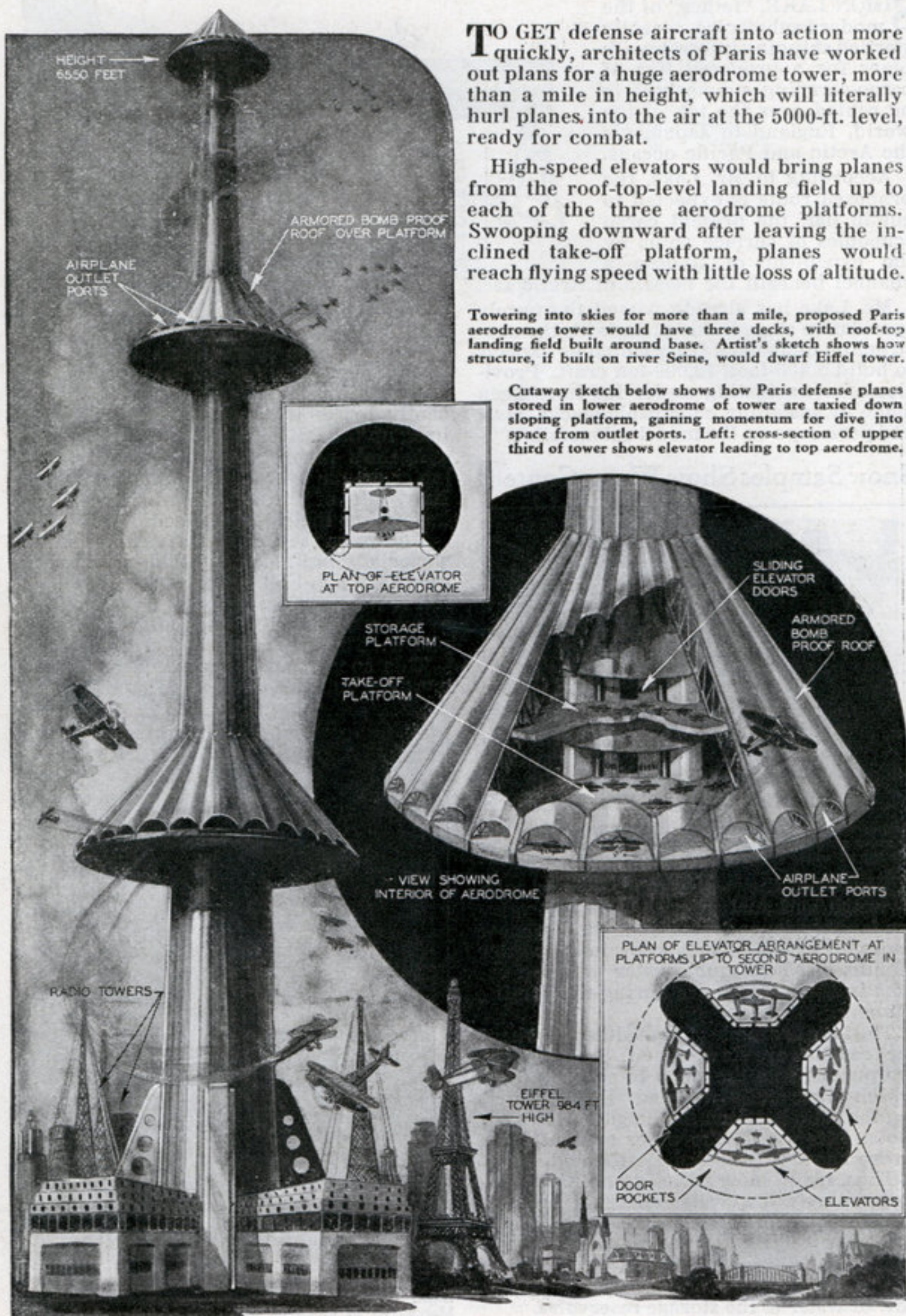
"I have found no relics of the past in my deep-sea work."

Looking at a photograph of the Loch Ness "monster," Roy Chapman Andrews, American explorer, and Dr. Ludwig Heck, of the Berlin zoo, agreed that it was a killer whale and what resembled a neck and head, was its dorsal fin. Someone else said it might be a species of newt, grown enormous by some freak of nature. Still, the mystery stands: "Is there a sea serpent?"

People around Vancouver, B. C., retort, "I'll say there is!"

At the end of January, two youths named

Giant Air TOWER to GUARD PARIS



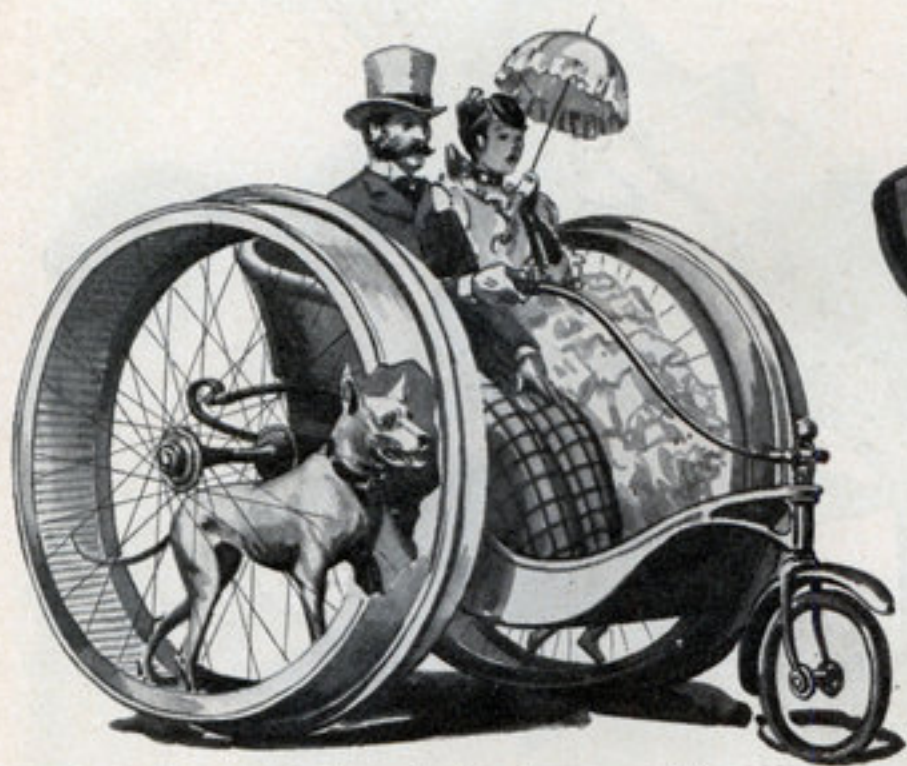
TO GET defense aircraft into action more quickly, architects of Paris have worked out plans for a huge aerodrome tower, more than a mile in height, which will literally hurl planes into the air at the 5000-ft. level, ready for combat.

High-speed elevators would bring planes from the roof-top-level landing field up to each of the three aerodrome platforms. Swooping downward after leaving the inclined take-off platform, planes would reach flying speed with little loss of altitude.

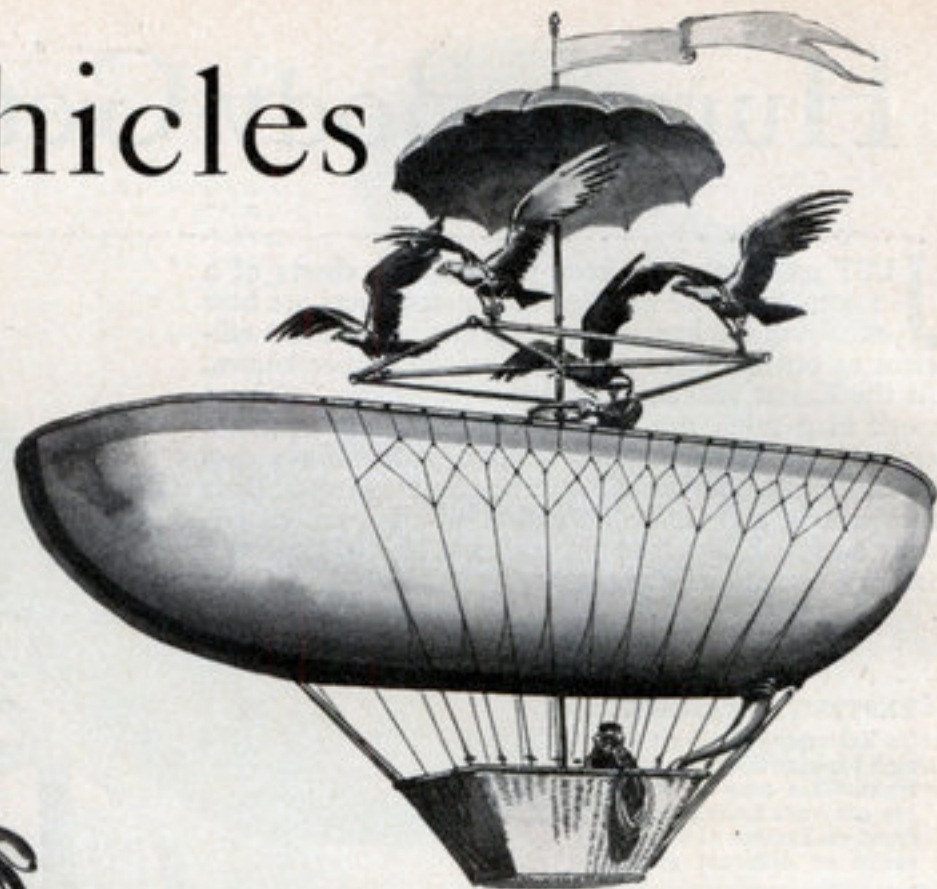
Towering into skies for more than a mile, proposed Paris aerodrome tower would have three decks, with roof-top landing field built around base. Artist's sketch shows how structure, if built on river Seine, would dwarf Eiffel tower.

Cutaway sketch below shows how Paris defense planes stored in lower aerodrome of tower are taxied down sloping platform, gaining momentum for dive into space from outlet ports. Left: cross-section of upper third of tower shows elevator leading to top aerodrome.

• Freak Vehicles



The Cynosphere, an 1880 inventor's idea of an automobile. Each of the two rear wheels contained a large dog. These propelled the vehicle forward by running on a track in the wheels, exactly as a squirrel whirls a ball inside its cage.



Eagles and vultures, wearing corsets, were to steer this fantastic dirigible airship. The birds were attached to a movable framework. By turning this, the ship would be piloted up, down, right, or left.

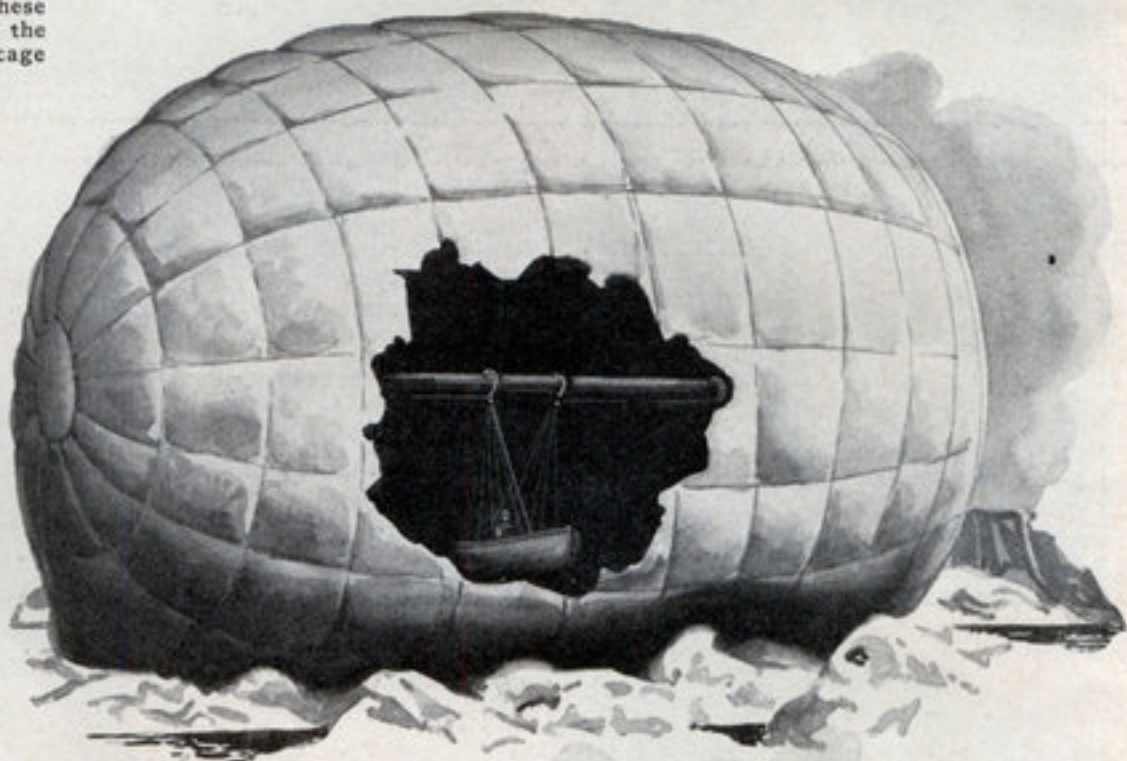
RIDING to the North Pole pulled by a kite! Crossing the Sahara in a juggernaut with fifty-foot wheels! Galloping along the ground on a mechanical horse with steel-pipe legs! Rolling over trees and houses in a 115-foot canvas ball blown by the wind like a tumbleweed!

Such are the curious, fantastic forms of conveyance inventors have proposed in the long search for swifter travel. Digging into the files of old newspapers and patents, you find a fascinating record of the inventive mind grappling with the problems of increasing human comfort and speed. It is a chronicle of queer ideas, of freak vehicles, of oddities of transportation.

Only a few weeks ago, a California inventor added to this list by obtaining a patent upon a water craft designed to roll across the surface of the sea.

His ship (see this month's cover) is a gigantic ball of metal with a streamlined passenger cabin trailing high behind on a Y-shaped arm of steel. Heavy Deisel-electric engines inside the ball roll it forward through the water by running up the side on an endless track like a squirrel in a cage. Fins, jutting around the tread of the ball, grip the water and aerial propellers at either end of the axle steer the craft to left or right. Passageways, running through the hollow supporting arm and axle, connect the cabin and the interior of the ball, while a gyroscope holds the craft erect upon the water. The inventor expects his vessel to be used for amusement-park purposes and in addition be valuable for transport work.

Ships designed to roll like wheels across the surface of the water have been proposed by many men. A quarter of a century ago, one, nicknamed the "Steel Log Steamer", was built and given a 200-mile test in Canada. The invention of a Toronto lawyer, it was a 110-foot hollow steel cylinder with



Filled with hydrogen, this huge canvas bag was a balloon; inflated with air, it was to be rolled along by the wind. The inventor actually rolled across Lake Michigan in it, but lost his life attempting to reach shore.

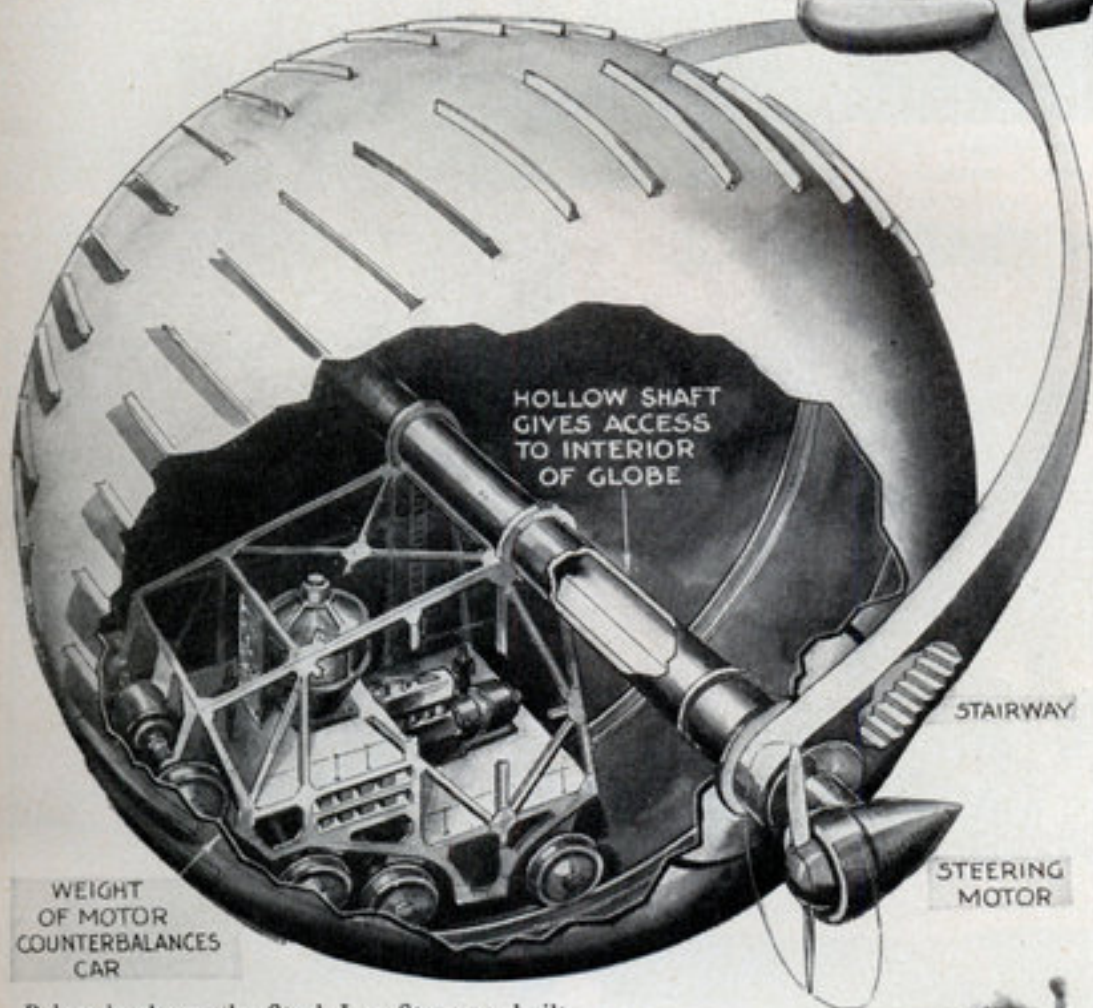


Here is the walking steam engine, built and tested in England about 1900. Note how the wheel treads resemble the feet of an elephant, making them suitable for travel on any kind of ground.

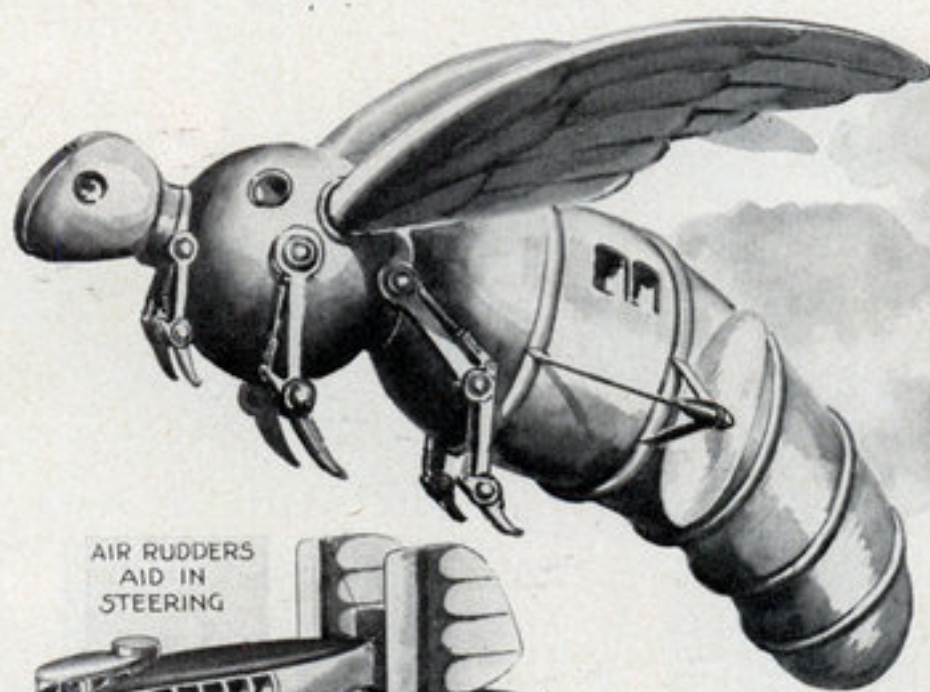
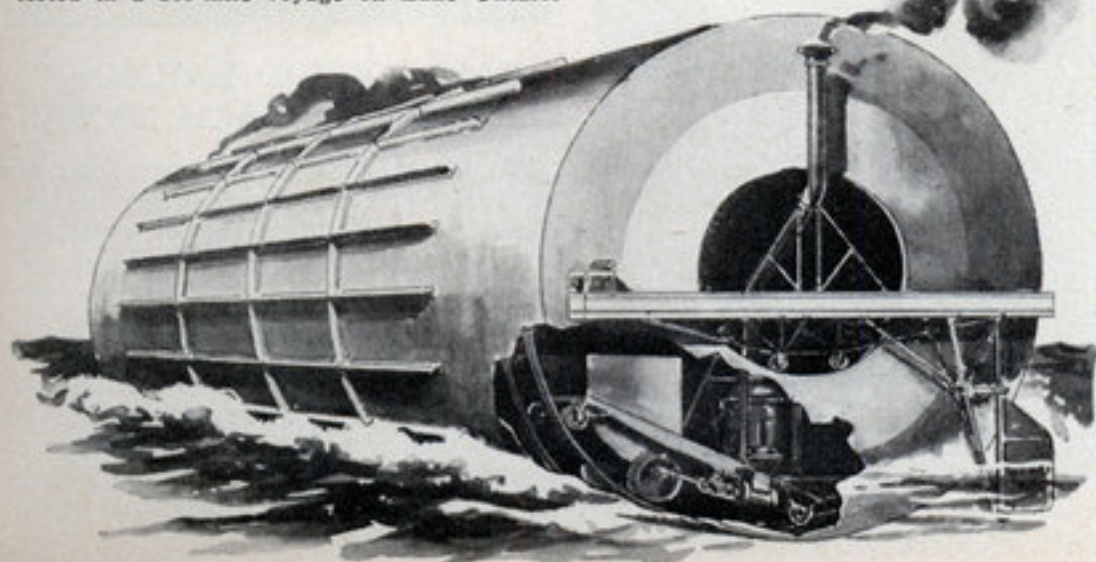
for Air, Land, and Water •

BIRDS, Dogs and Other Animals Used to Propel the Odd Boats, Wagons, and Airships Inventors Have Devised in Their Efforts to Bring About Faster, Safer, and More Certain Ways to Travel

The rolling ball, below, recently patented, is designed to be driven on water by heavy engines inside running on an endless track. Steering is to be accomplished by motors at the sides, and passengers are to ride in the lofty cabin



Below is shown the Steel Log Steamer, built in Canada thirty years ago and successfully tested in a 200-mile voyage on Lake Ontario



A Belgian inventor produced this huge insect as his contribution to safe air travel. Flapping wings were to propel it and in landing it was to fall back on the telescoping air bag

rudders at each end and a wide row of fins encircling the middle. Inside the cylinder, two small locomotives, one near either end, puffed away on endless tracks, running up the side to roll the freak craft broadside through the water.

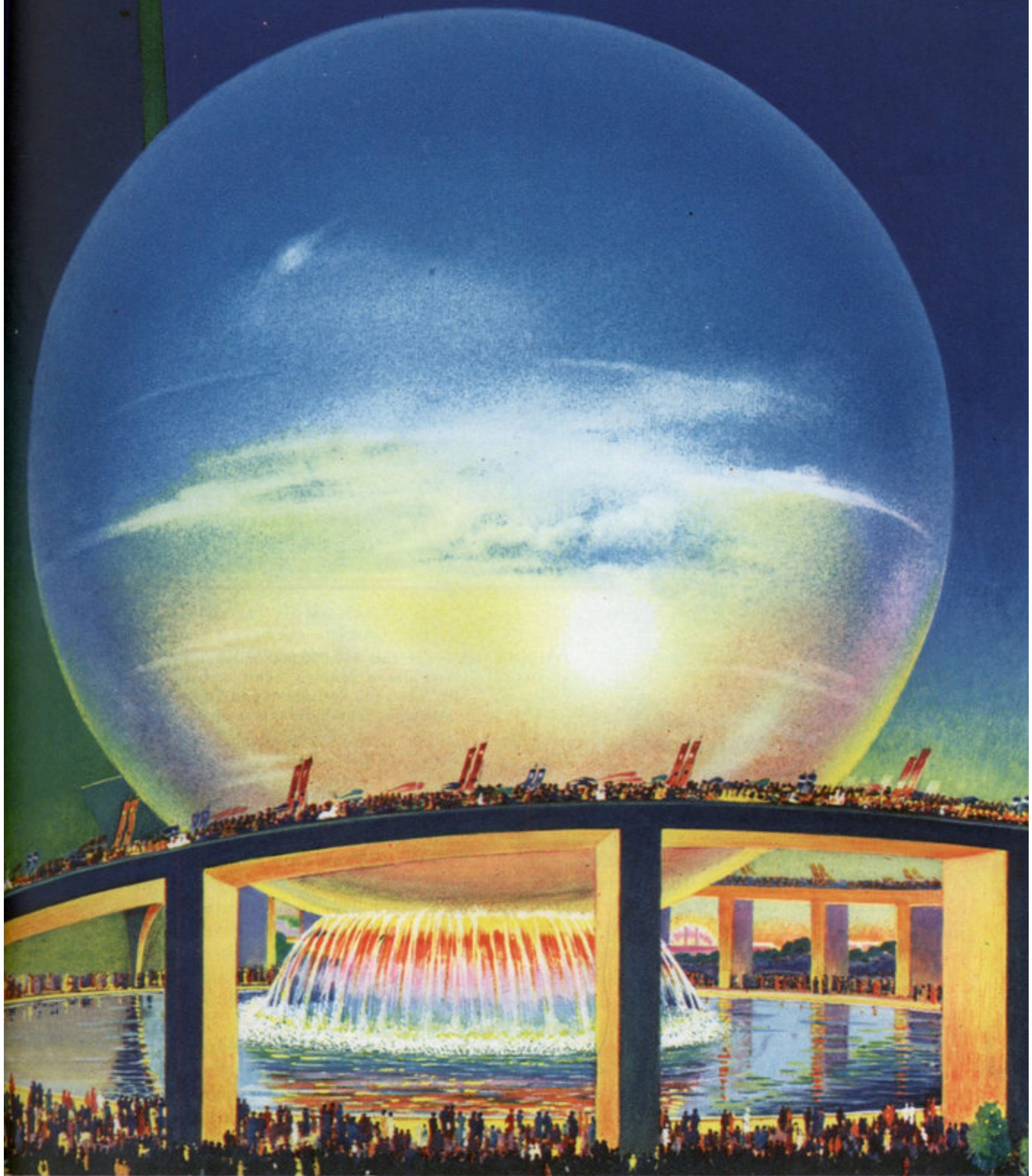
It was completed in 1906. In a final test, it rolled from Toronto down Lake Ontario to the St. Lawrence River and down the river to Prescott, Canada, opposite Ogdensburg. With the engines going full tilt, the curious vessel attained a speed of six miles an hour. At the time, the inventor planned to construct a trans-Atlantic liner built on the same principle. It was to be 800 feet long and 200 feet in diameter. Sitting down with a pad and pencil, he calculated that if he could obtain only twenty-five revolutions a minute from this huge rolling log, he could attain trans-oceanic speeds of 200 miles an hour with his strange rolling craft.

While its speed was nothing to brag about, another application of squirrel cage power caused considerable comment in America fifty years ago.

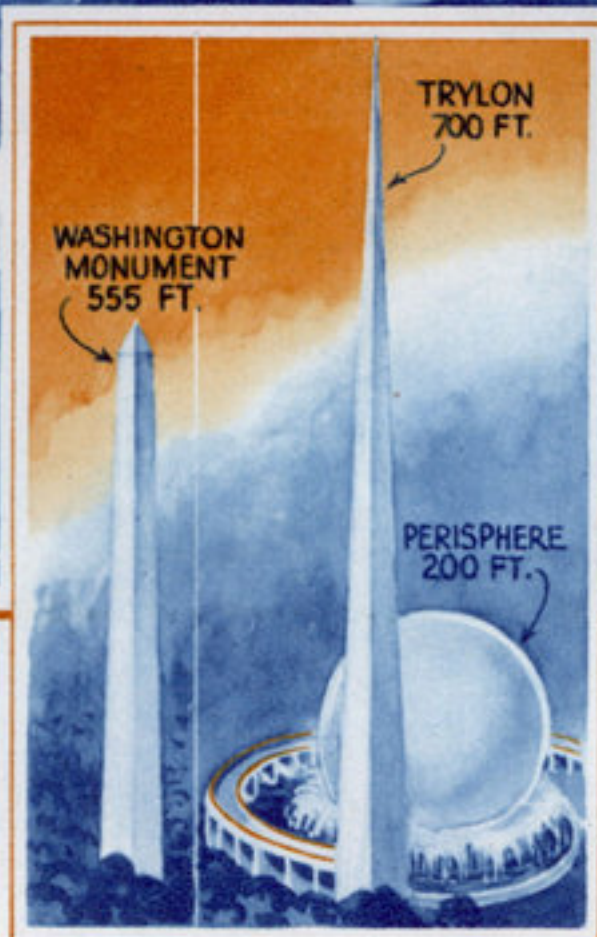
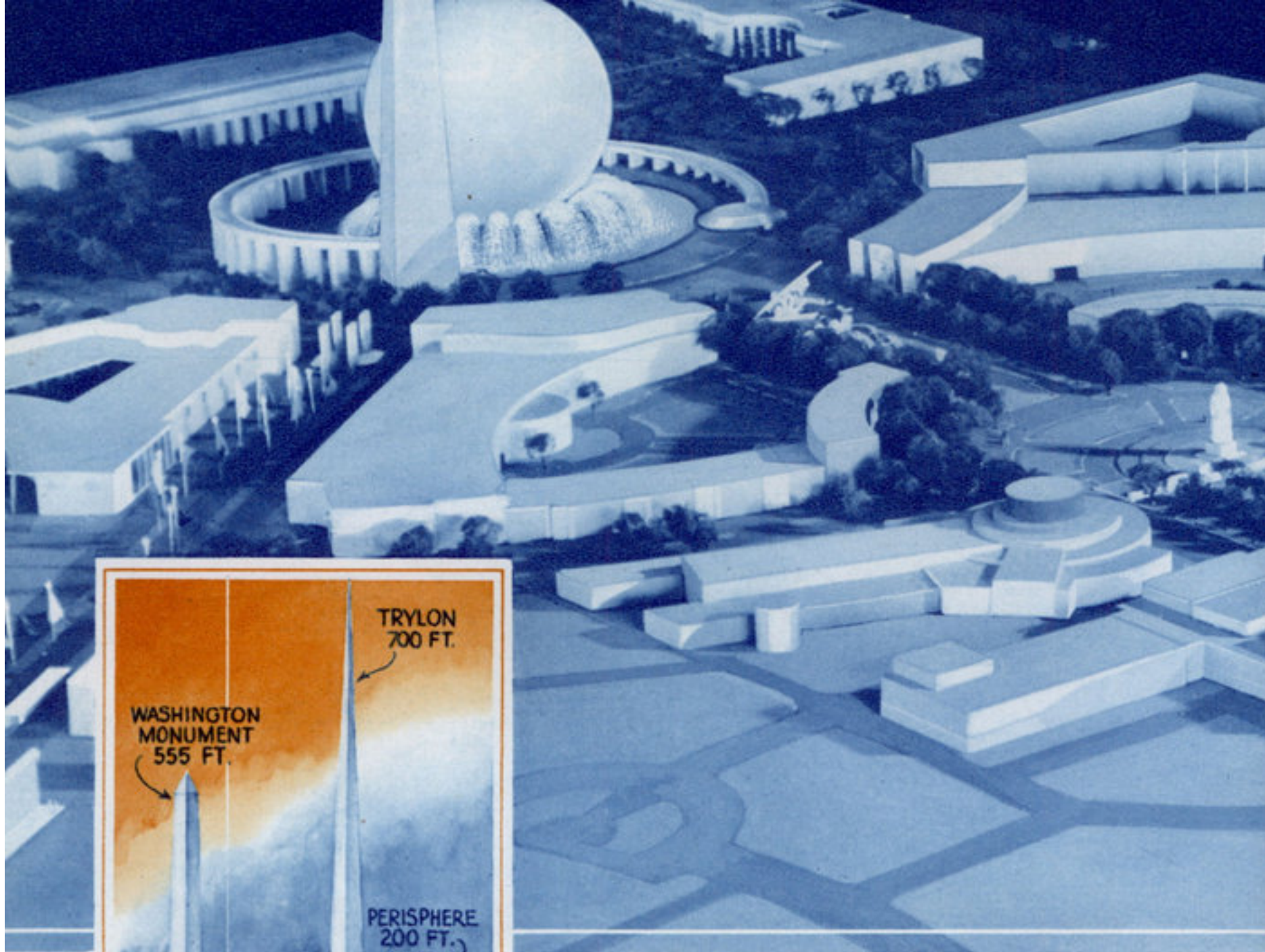
A French engineer designed an apparatus called a Cynosphere. It was a tricycle with a small steering wheel in front and two large and curious wheels behind. Each of the rear wheels was shaped like a circular cage and contained a large dog. These "power-plants" rolled the carriage ahead by running squirrel-fashion on narrow tracks.

The operator sat in a sulky seat between the wheels and could throw the motors into "high" by exhibiting food or even a cat on special occasions. Whenever the dogs became tired, the engineer pointed out, the operator could change engines by replacing them with other animals. Patents on the idea were taken out both in France and the United States. The French Society for the Prevention of Cruelty to Animals was consulted and was said to have given its sanction to the plan. (Continued on page 96)

The WORLD of TOMORROW



NIGHT view of the Perisphere at the New York World's Fair of 1939, as conceived by an artist. Moving patterns of colored light on the ball will cause it to appear to turn.



MIDDLE sector of the \$60,000,000 mile-long Central Mall which will extend like a jeweled band across the main exhibit area. Inset shows the Perisphere and Trylon as compared with the Washington monument.

AMERICA'S largest city next year will stage the world's largest fair, a \$150,000,000 exposition costing about three times as much as Chicago's famed Century of Progress.

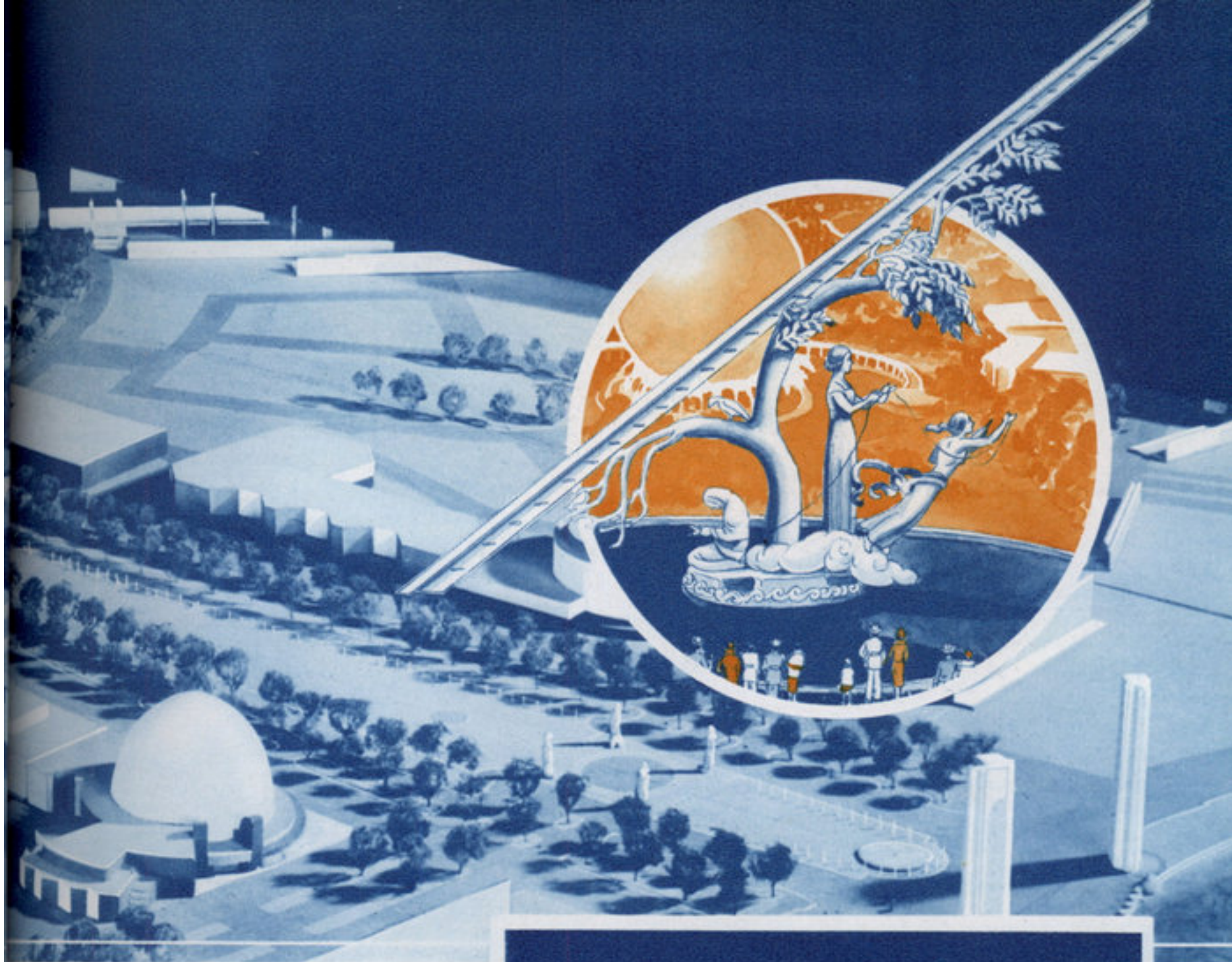
In addition to costing three times as much, the New York fair will be three times as big as the Chicago fair. The Century of Progress covered 424 acres. The New York World's Fair of 1939 will extend over 1,216 acres.

In fact, New Yorkers point out happily, if Chicago's Columbian Exposition and Century of Progress were combined, both of them together would not be as large in area or as costly as the fair New York is planning. And whereas the Century of Progress attracted about 38,650,000 visitors in two seasons, New York

expects to entertain 50,000,000 visitors in six months.

Building the world of tomorrow will be the New York fair's central theme and when it opens next April 30, just 150 years after the inauguration of George Washington in New York City as our first president, it will present an example of man-made magic as amazing as the blooming of a lily out of the mire. For Flushing Meadow Park, the exposition site on Long Island, was formerly a city dump and this fair is rising out of a mountain of ashes to demonstrate how the tools and processes and knowledge of today can be used to create a better world tomorrow.

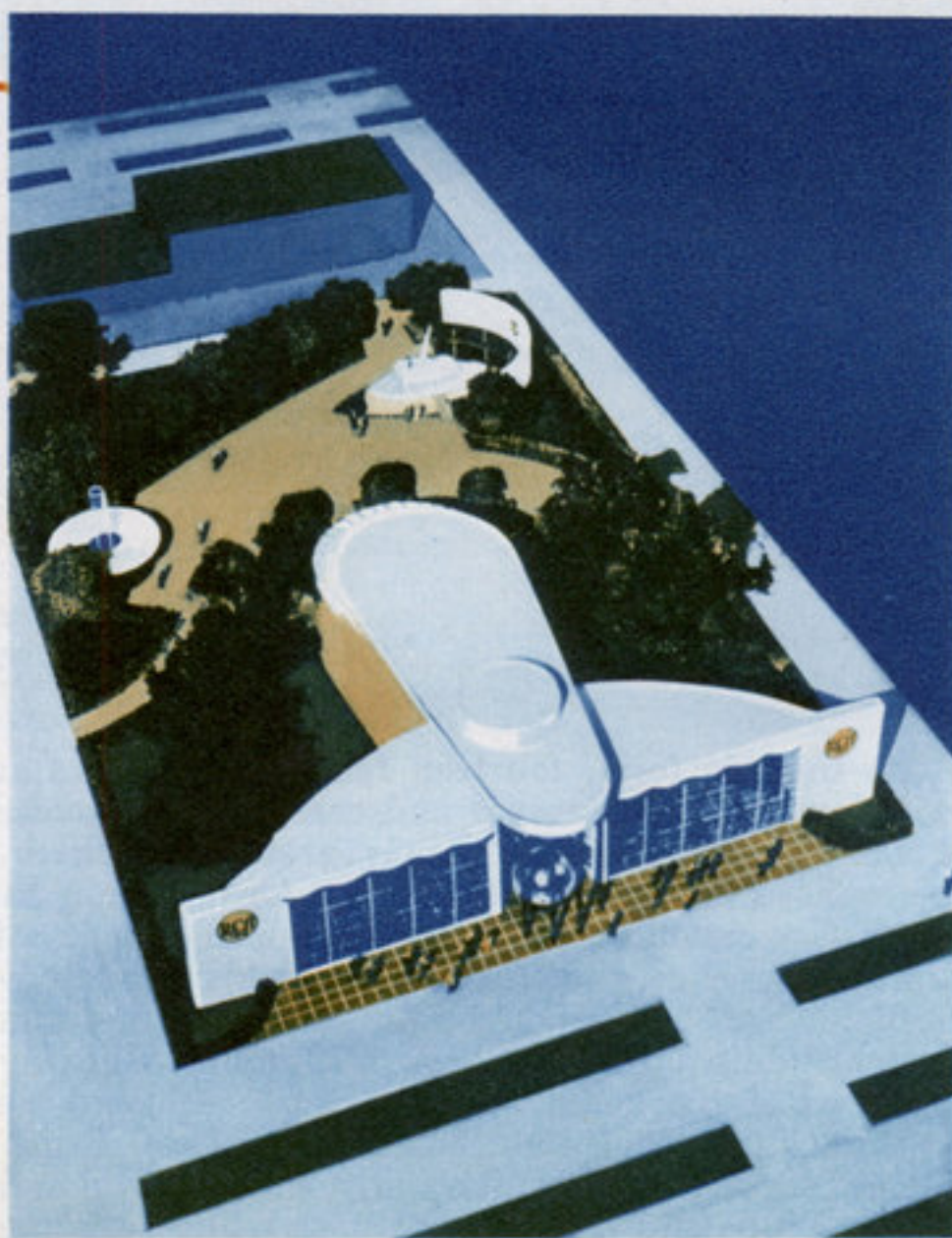
The theme center of the exposition and the dominant architectural feature is to



TELEVISION programs will be featured in the RCA building, shaped like a radio tube, shown in model form at right. In circle, model of a fifty-foot sundial.

be a white globe 200 feet high seemingly poised on a cluster of fountains and flanked by a 700-foot triangular shaft. This great white ball, called the Perisphere, will rise eighteen stories above the ground and will be broader than a city block. Except for the tower, it will be the fair's highest structure and will house the key exhibit, a spectacular portrayal of the world of tomorrow.

An endless stream of humanity will flow into the Perisphere night and day by way of a glass-enclosed moving stairway, the world's longest. From the top of this flight, five stories above the ground, visitors will step on a "magic carpet" or circular moving platform for their journey into the world of the future.





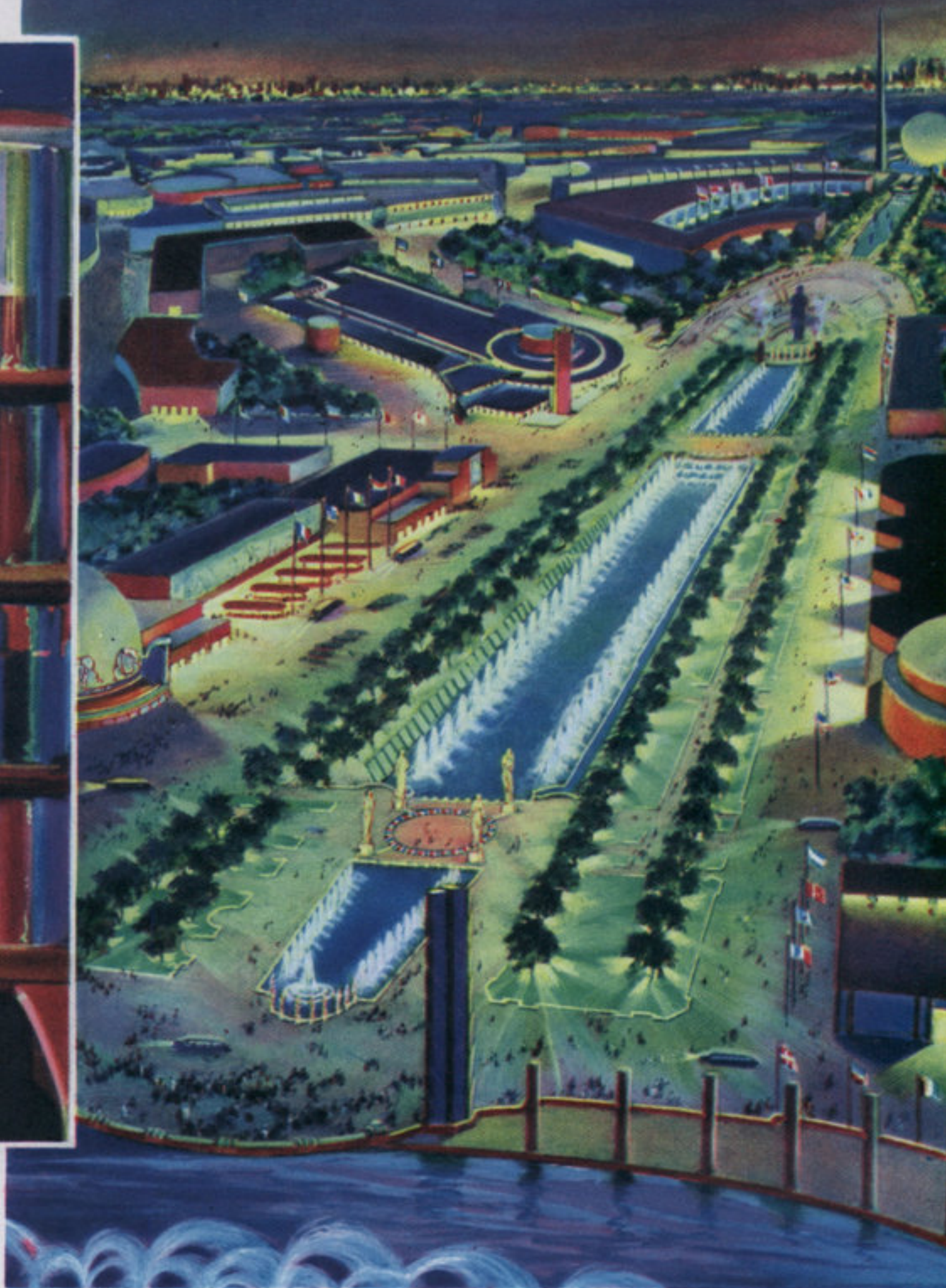
WORKING model of an interplanetary rocketport of the future at the moment the rocket departs. Ships, planes and trains of tomorrow will also be seen in model form.

As this platform, fourteen feet wide, 450 feet in circumference and carrying 1,200 passengers, moves slowly around the sphere, the crowds will gaze down on a vast panorama showing cities and towns, factories and farms and fields stretching off to the horizon on all sides and blending into the clouds and light patterns of the dome.

Here will be shown all the elements of society linked together for the common good. Ships and trains and trucks will be observed bringing raw materials from

farms and fields to cities and factories, and carrying manufactured products back to the country. A voice will explain the significance of all this movement, stressing the fact that each person today is dependent for his existence on the efforts of many other persons and pointing out how the problems of living have been simplified by cooperation.

From the exit, visitors will cross a bridge linking Perisphere and tower, descending a stairway inside the shaft or walking down a 900-foot "helicline" or

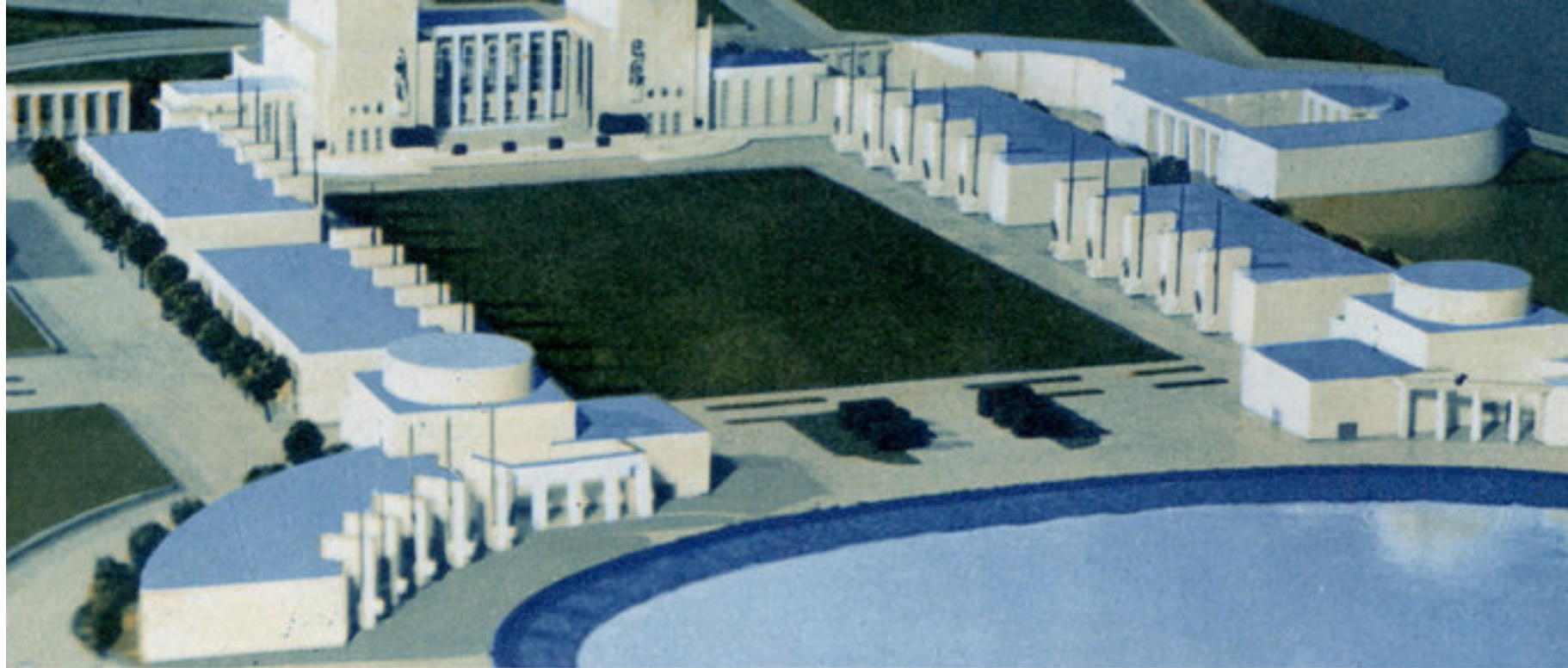


NIGHT scene along the Central Mall as conceived by an artist. Mercury vapor lights, sunk in the ground, will cast a glow into the trees, causing the under sides of the leaves to fluoresce and bathe the entire area in a luminous radiance after dark.

ramp winding around the fountain basin beneath the sphere. The top of this helieline, fifty feet above the ground, will be the highest point to which visitors will be admitted and will command a view of the entire fair.

Spectacular illumination will make the globe an awe-inspiring sight at night. Batteries of projectors will spot the sphere in color and other projectors will superimpose moving patterns of light on the ball, creating the illusion that it is a glowing, almost transparent bubble of changing color rotating lazily atop supporting clusters of spouting fountains.

Actually, the Perisphere, of articulated steel frame construction with a light outer covering and weighing more than



COURT of Peace, above, with the imposing federal building at one end of vast parade ground. Below, artist's sketch of seventy-foot entrance facade of Hall of Communications.

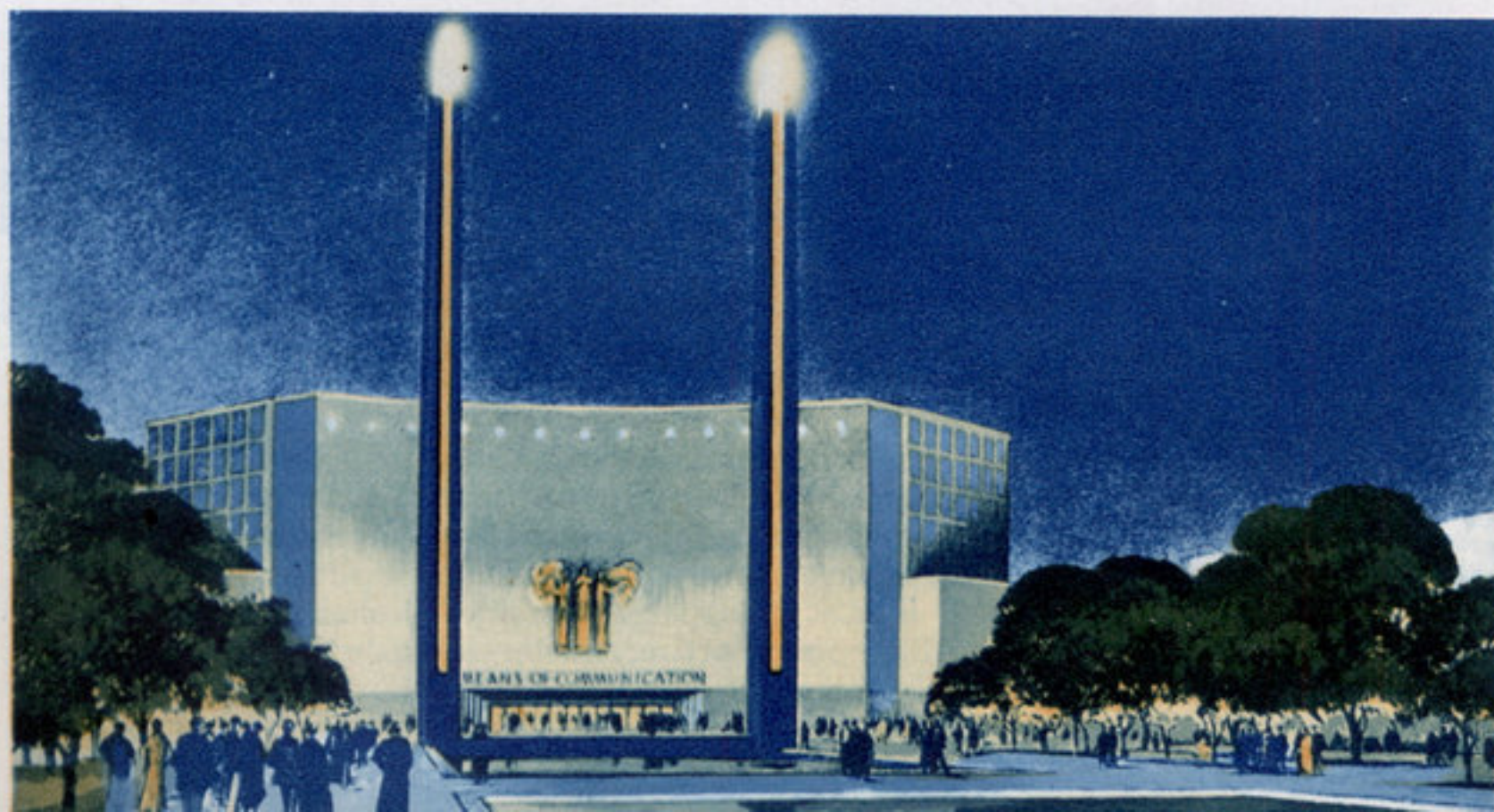
9,000,000 pounds, will be supported on eight sturdy columns but spectators will not see them because they will be encased in glass and water will be pumped up around them, making it appear that the bubble is held up by the rush of water.

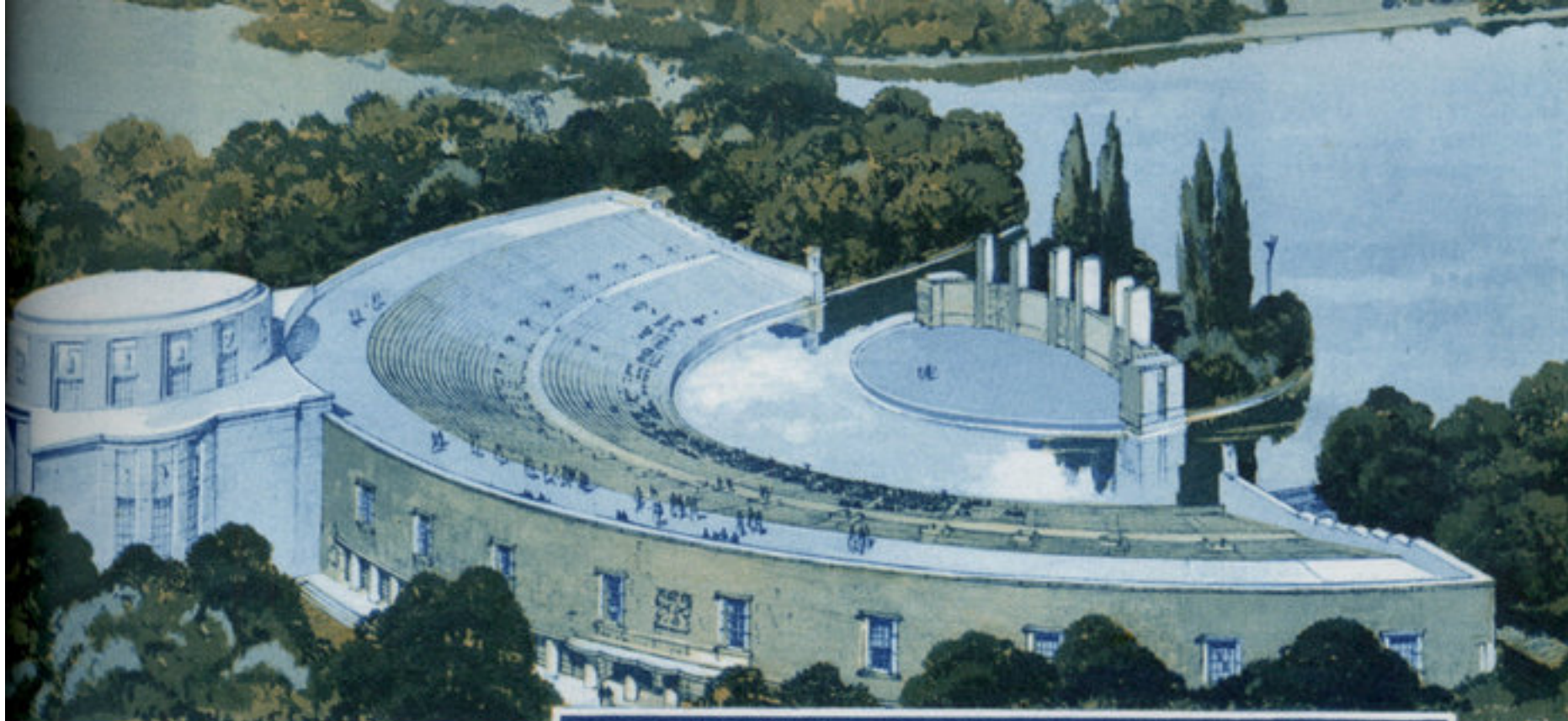
The shaft, christened the Trylon, half again as tall as the Washington monument, will have a triangular base of sixty-three feet on each side and will serve as a fair guidepost since it will be visible for miles. It also will be a steel frame with a light covering and, while it has not been planned to use it for observation purposes, there will be space for installing elevators.

The Trylon is not to be illuminated at

night, except for reflected light, but will serve as the source of fair broadcasts. From it the "voice of the fair" will issue announcements over a new type of long range sound projector which will make it possible to blanket the entire grounds with beams of sound, thus eliminating overlapping and unpleasant variations in volume.

Water, flame, color and sound in almost incredible proportions are to be combined in providing two nightly spectacles expected to rival in sheer size and grandeur anything ever conceived by man for entertainment alone. One spectacle will feature the play of super-fountains and super-flames, synchronized with color effects, music and sound.

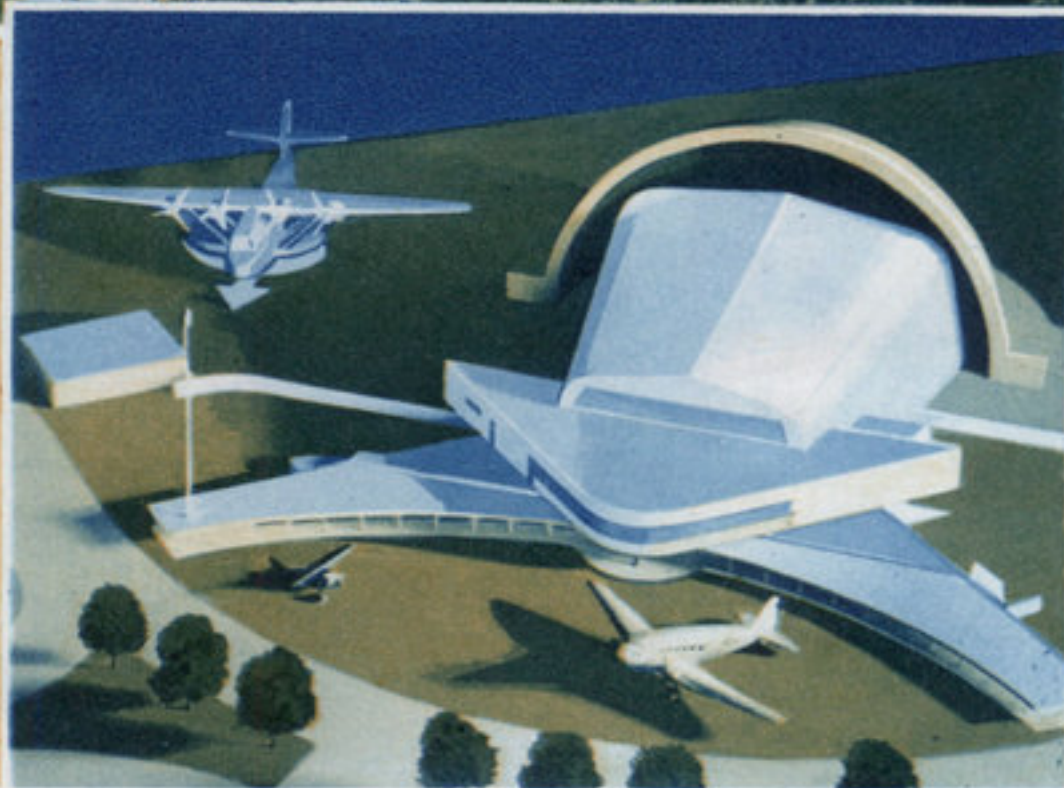




The other will be a man-made Niagara plus a man-made Vesuvius, an approach to chaos.

Hydraulic engineers, gas-company chemists, fireworks manufacturers, illumination experts, musicians, display engineers, architects, color specialists and artists collaborated in planning these two displays which require installations costing \$700,000 and which are on so large a scale that two gas companies have united their resources to assure enough fuel.

The controls for these spectacles have been planned so carefully that a composition in water, flame, color and sound can be "played" from a central



MARINE amphitheater and island stage, top, which the State of New York will erect and where great pageants and spectacles will be presented. Above, model of the \$250,000 Aviation building. Below, twin ship prows, each eighty feet high, will give a nautical touch to the main entrance of the Hall of Marine Transportation.





ARTIST'S sketch of a nightly spectacle in which water, flame, color and sound will be combined in almost incredible proportions. At the touch of a control, fountain jets and towers of flame 150 feet high will spring from hundreds of water nozzles and gas burners to form awe-inspiring designs.

board much as one would render some great work on a pipe organ. At the touch of one control, a thousand fountain jets, some 150 feet high, can be made to spring from invisible sources, or towers of flame equally high can be produced to combine with the uprushing water in a furious battle of the two elements.

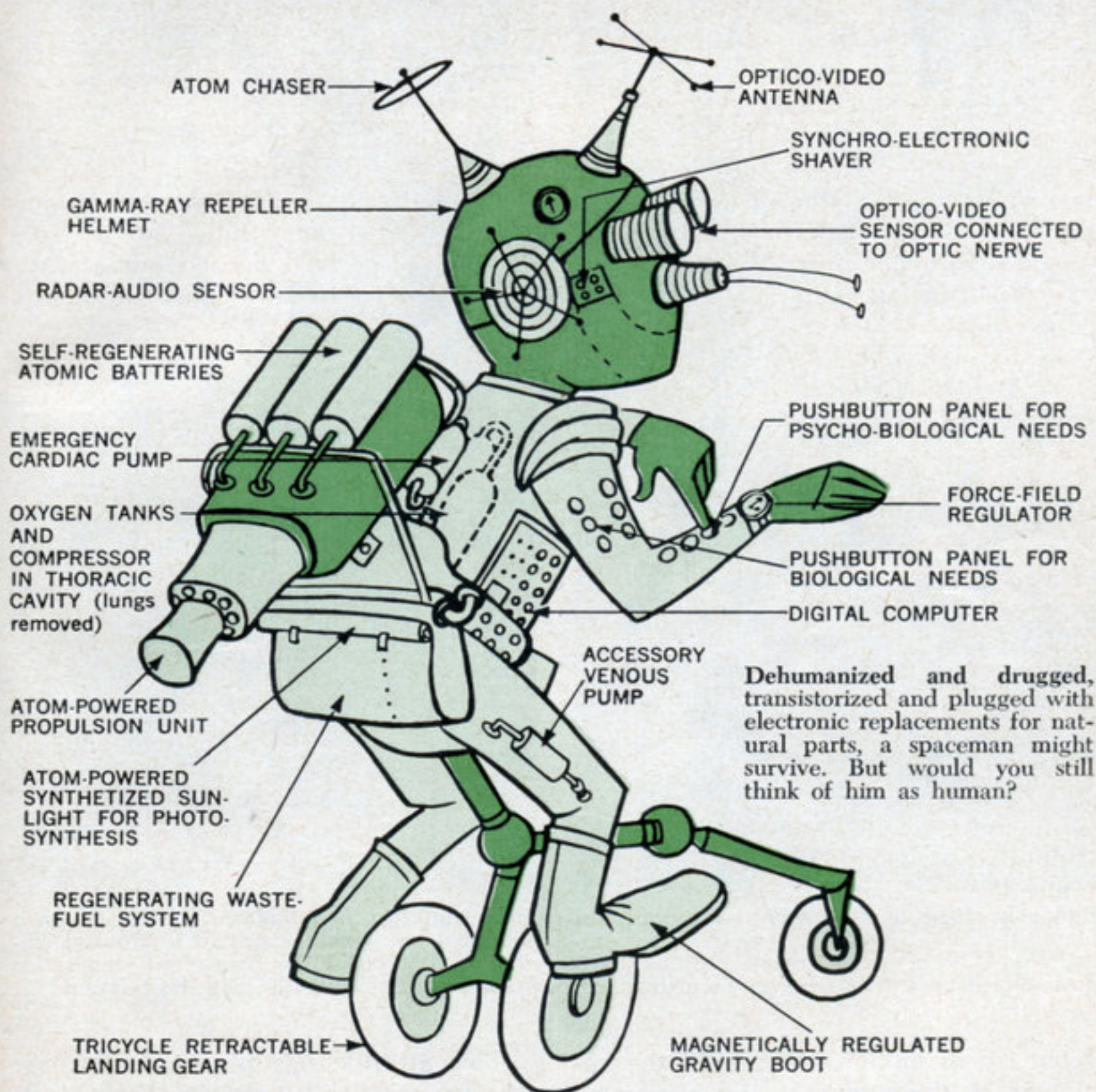
Then, at the height of this display, all valves can be closed so quickly that fifty tons of water will seem to hang suspended in midair. The apparent color of the water and the actual color of the fire can be controlled as easily, and the strains of a violin or music as tremen-

dous as thunder can be produced from the very heart of the spectacular turmoil.

One spectacle will be presented from an 800-foot lagoon in the main exhibit area, the other from a lake in the amusement zone. The lagoon display will require 1,000 water nozzles and many twenty-four-inch gas burners of the Bunsen type. Water nozzles will be grouped to produce the 150-foot columns, and one circle of jets which will produce a sheaf of golden wheat ninety feet high will require as much pumping force as would be exerted by sixty-two fire pumpers.

For the lagoon display, the many circles and pat- (Continued to page 128-A)

Must Tomorrow's Man Look Like This?



By Toby Freedman, M.D., and Gerald S. Lindner, M.D.

No electronic plug-ins needed, say these two doctors. Man's own capacity for adaptation, with help from science, can fit him for new ways of life

THE design of vehicles is one of the oldest and noblest arts of mankind. Look at a model of a prehistoric Polynesian canoe. It's as hydrodynamically elegant and functionally beautiful as the X-15. The wheel, the ski, the kayak, the sports car—pure

• BUILDING A WORLD'S FAIR

By EDWIN TEALE

FIFTY MILLION visitors—a number equal to nearly half the population of the United States—are expected to journey next year to the New York World's Fair. With lights and flame, motion and sound, this \$175,000,000 show will dramatize the progress and the promise of science. It will reveal the World of Tomorrow as it is foreseen today.

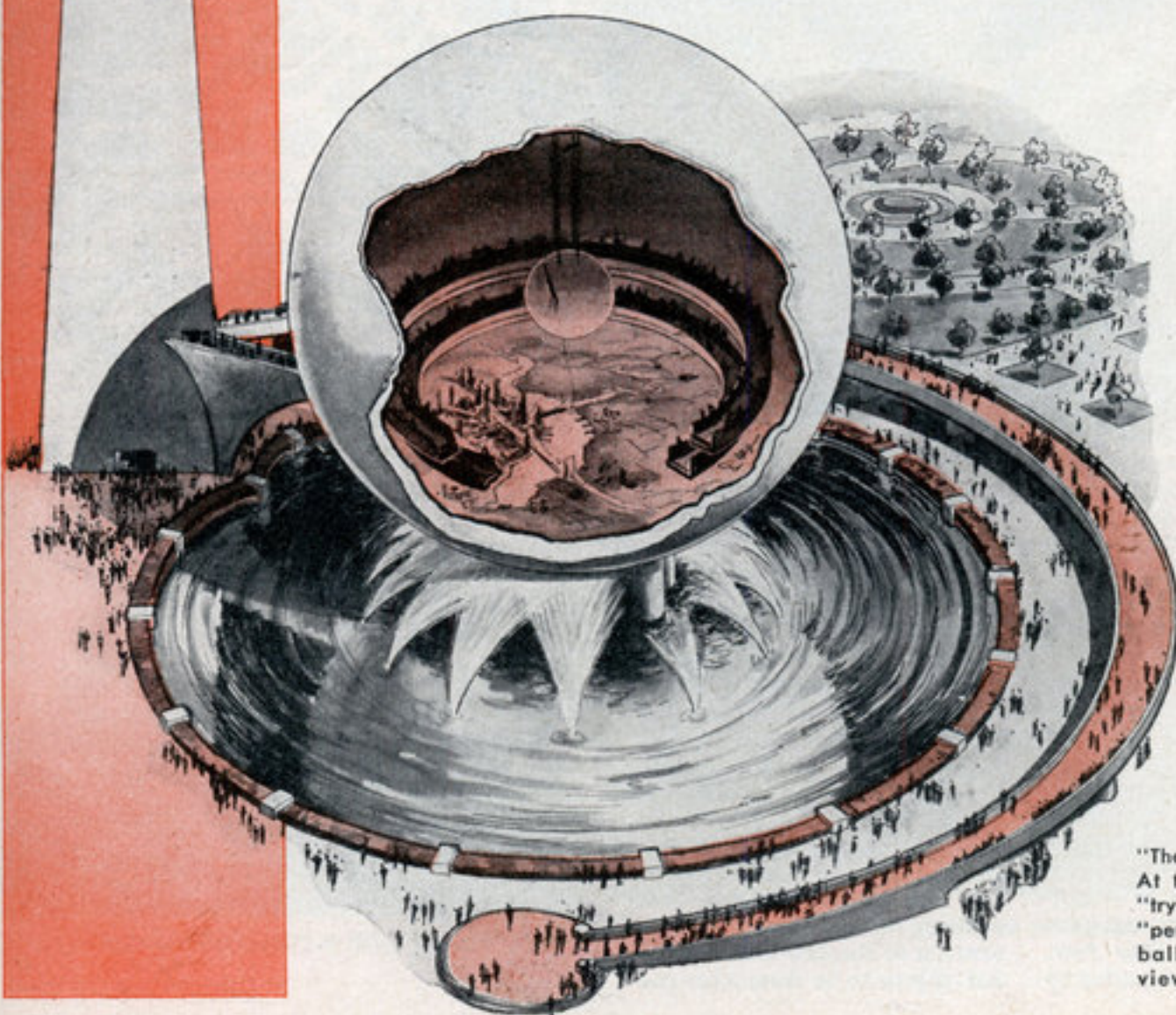
At this writing, the exposition site is a vast beehive of activity. The pounding of carpenters' hammers, the crash of pile drivers, the roar of dump trucks, the machine-gun rat-a-tat of riveters fills the air. Buildings seem to rise overnight. A thousand and one projects are being carried out at the same

time. Roads, bridges, artificial lakes, transplanted forests, synthetic soils appear as though by magic. The whole story of the 1939 World's Fair is a story of science in action.

Even the ground upon which the buildings will stand is a product of scientific advance. Late in June 1936, a mechanized army of workers began a 190-day siege of the dreary stretch of swampland, formerly an ash dump, near Flushing on Long Island. Using power shovels, dump trucks, bulldozers, and gas-driven draglines, 500 picked men worked, in shifts, twenty-four hours a day. On weekends, a crew of crack mechanics overhauled the equipment. During the operations, more

than 1,000,000 gallons of gasoline exploded in the cylinders of the engines and \$80,000 worth of electric current was consumed by the floodlights which blazed at the top of twelve eighty-foot towers throughout the night. In all, nearly 7,000,000 cubic yards of material were moved before the job was completed.

Then followed an exhibition of chemical wizardry. Instead of stripping hundreds of acres to obtain the fertile topsoil needed for grass and trees, scientists created it chemically from the salty, acid, fibrous root soil of the swamp, of which approximately 800,000 cubic yards had been set aside for the purpose. Through two years



"Theme center" of the fair. At the left is the 700-foot "trylon," and beside it the "perisphere," a huge hollow ball in which visitors will view a city of the future



A WONDERLAND

This is how the exposition grounds will appear from the air. Spreading around the theme center will be educational exhibits, industrial displays, and amusement places

of intensive research, the scientists had discovered a way of converting this material into soil of high fertility. They treated it in half a dozen ways, plowed it, windrowed it with lime, added phosphates and nitrogen, composted it with raw manure. In the end, it turned into the material desired. By this feat alone, science saved the fair half a million dollars.

For the landscaping of the fair grounds, a forest of trees began moving toward the site. Experts, equipped with large books giving the sizes, shapes, and kinds of trees required, had been scouring the country for hundreds of miles around. They had catalogued upward of 10,000 available trees. In the largest mass movement of the kind on record, railroad flat cars and motor trucks began rolling toward New York bearing a wide variety of full-grown trees, some weighing as much as twenty-five tons and having a height of more than fifty feet. Following one-way streets and guided by

police cars, most of the trucks passed through New York City in the early hours of the morning, reaching their destination before daylight. Here, huge machines lifted the trees into place while Diesel-driven bulldozers shoved the dirt around the roots and ran back and forth to tamp it down.

This migration of 10,000 trees, dramatic as it is, forms but a small part of the vast activity necessary in the preparation of the fair site. On the list of jobs to be done were the



Already built, the administration building of the

ENGINEERING SKILL AND SCIENTIFIC RESEARCH COMBINED TO CREATE A MAN-MADE WONDERLAND DEPICTING THE MAGIC WORLD OF TOMORROW

construction of seventeen miles of roads, fifteen miles of gas mains, ten bridges, and two artificial lakes. A tidal dam and a \$700,000 marine basin on Flushing Bay, which will permit motor boats and excursion vessels to dock at the grounds, are well on their way to completion.

At the same time, the first of the buildings which will form the rainbow-hued Arabian Nights assemblage of the fair, were going up. To be sure that the best obtainable materials were used, the exposition scientists built a curious field laboratory unlike any other in existence. Supported on immense jacks, the structure could be warped and twisted at the will of the engineers. Under actual outdoor conditions, they were able to subject materials, ranging from stucco to steel beams, to a wide variety of tests.

Most spectacular of the structures being made from the selected materials are the "trylon" and "perisphere," which will form the "theme center" of the fair. The first is a slender obelisk rising 700 feet into the air; the second is a pure-white ball 200 feet in diameter. They can be seen for miles around and will provide a landmark for visitors arriving by air, water, and land.

To form the foundation for the 8,000,000-pound trylon, eleven miles of wood piling, a whole inverted forest of ninety-five-foot fir trunks, were driven into the ground. The designs for the trylon and perisphere were selected from more than 1,000 sketches submitted. The cost of construction will be \$1,200,000.

Within the hollow globe of the 5,700,000-pound perisphere, "magic carpets" will carry visitors in a circle above an immense model representation of a city and countryside of the future. Two 100-ton platforms, shaped like gigantic metal washers, will form the "carpets" on which spectators will ride. Special lighting will make the supporting pillars invisible while the platforms revolve at a steady pace of thirty feet a minute. Visitors will have the sensation of riding silently through space above a wide-spread countryside.

Outside the perisphere, water, spraying from a series of fountains, will hide the

eight columns which provide support. The great ball, nearly a block in diameter, will appear to be floating in space. At night, colored lights and moving patterns will be projected on the outside of the sphere, producing the illusion that it is revolving.

To carry spectators to the entrance of the perisphere, five stories above the ground, the longest moving stairway ever built in this country will be provided. A steady stream of 16,000 persons an hour will be able to ride up the incline. After the trip through the perisphere is over, visitors will descend to the ground by means of a circular ramp. During this descent, they will have an opportunity to view the whole colorful panorama of the fair spread out below them. A sweep of the grounds will carry the eye through all the colors of the spectrum, succeeding one another in their proper order, from red to violet.

Spreading away from the theme center of the fair will be a seemingly endless succession of exhibits. Among the most spectacular will be the gas-industries display with its tall central plume of fire and its quartet of ninety-foot pylons, each with writhing snakes of colored flame running up the sides. In order to obtain the desired colors, experimenters worked for months adding chemicals to gas in laboratory tests. As a result, they have half a dozen brilliant hues at their disposal. At present, attempts are being made to mix fire and water, combining fountain sprays and colored flame. During the exposition, men operating batteries of valves within the "Court of Flame" exhibit will control and blend the varicolored plumes of fire.

The consumption of gas by all the exhibits of the fair, during the six-months' run of the exposition, is expected to reach a total of nearly half a billion cubic feet. The fifteen miles of mains, which form an underground network at the site, have sufficient capacity to meet the needs of a large city.

The biggest single display at the fair will be the sixteen-acre, \$1,500,000 show presented by (Continued on page 120)



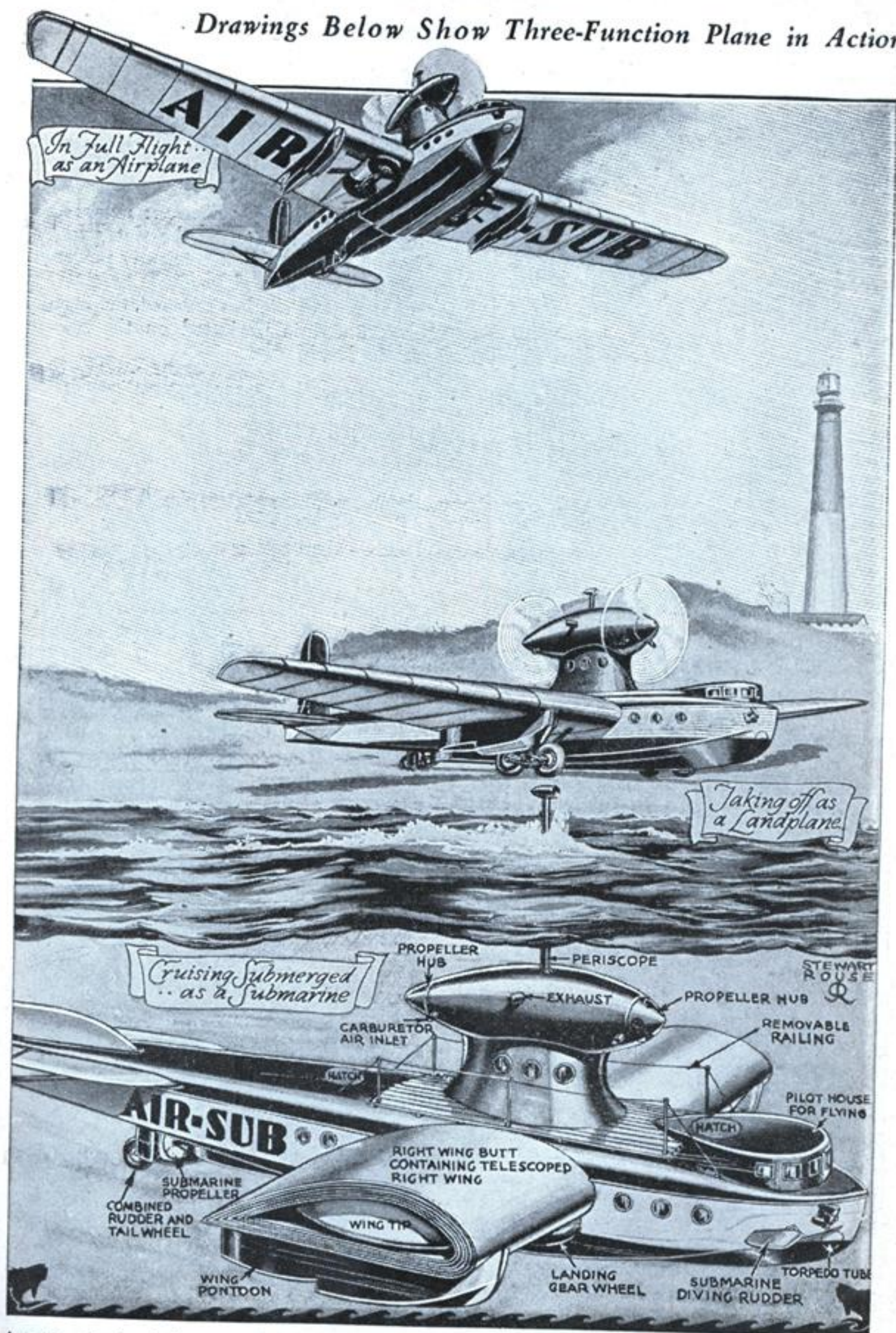
SPECTACULAR COURT OF FLAME

One of the most striking exhibits will be that of the gas industries, seen in the drawing above. Around a tall plume of colored flame will stand four massive towers, each wreathed in fire



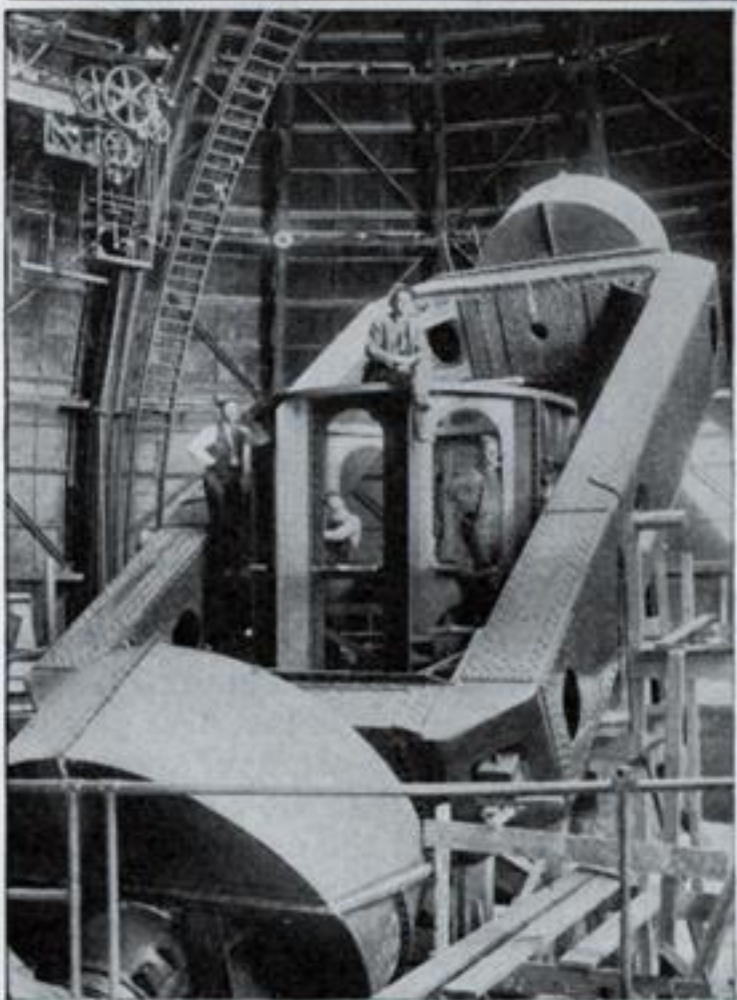
fair is an example of the modern design and scientific construction being used. It is air-conditioned throughout

Drawings Below Show Three-Function Plane in Action



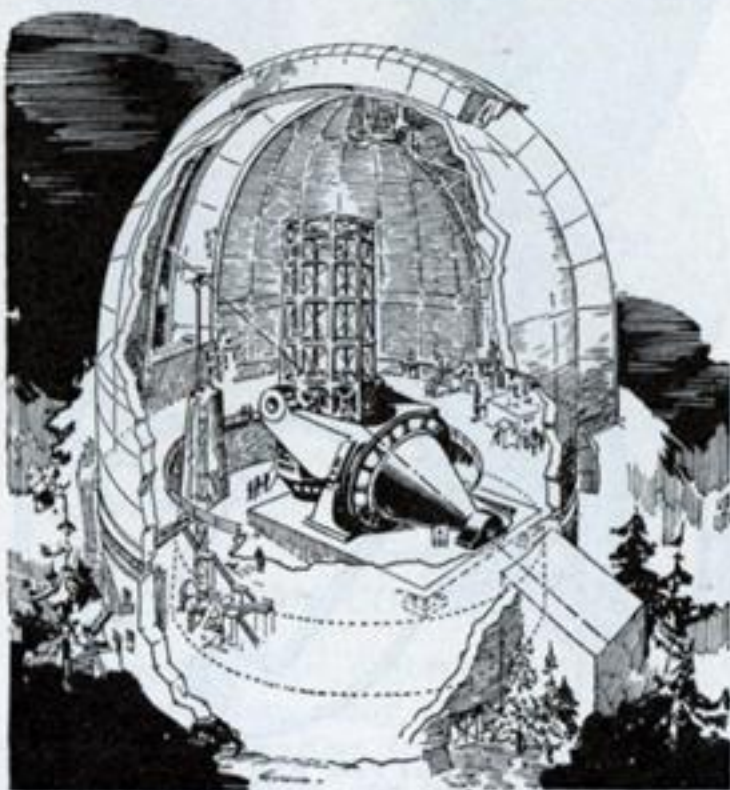
Amazing in the daringness of conception, and expected to be far reaching in strategical value from a military standpoint is the remarkable new submarine-amphibion airplane secretly tested by Denmark.

The WORLD'S



Looking at the heavens with the aid of the most extraordinary piece of glass ever poured, they may make discoveries that will completely change man's conception of the universe.

After years of research the men in charge of building the monster instrument for the California Institute of Technology are now at work. Astronomers estimate that the mirror, 360,000 times more powerful than the human eye, will magnify the moon and planets 10,000 times. Through the telescope the moon will appear only



Top, Photograph Made with 100-Inch Mount Wilson Telescope; Below, Erecting the Instrument

A GROUP of American astronomers soon will experience one of the greatest scientific thrills of the century. On the night the world's most tremendous telescope is completed they will take turns peering into a tiny, brilliant eyepiece.

BIGGEST EYE



York which provided the \$6,000,000 telescope fund. Drs. J. A. Anderson and Francis G. Pease of the Mount Wilson observatory are in charge of the work.

Instead of gathering light by lenses, all large astronomical telescopes use a curved mirror to gather the light from a star and focus it at one point inside the barrel of the telescope. There a prism diverts the light to a point outside the barrel, or a flat mirror returns the gathered light

Drawing Shows Position of Operator inside Tube of the Giant New Telescope; Note How Light Is Reflected by Mirror to Central Focal Point

twenty-five miles away, at which distance large buildings could be easily seen. The 100-inch telescope on Mount Wilson, only half the diameter of the newest instrument, can detect a candle flame 5,000 miles away. With the aid of this telescope approximately 2,000,000 nebulae, each as crowded as the Milky Way, have been found. It can peer into space a distance of 400,000,000 light years.

The new telescope, astronomers hope, will penetrate at least three times farther into space, thus opening an unexplored sphere thirty times the size of that now sounded. Already tasks that appeared insurmountable have been overcome in constructing the curved mirror that has 240 square feet of surface and is to be smoothed to an accuracy of two one-millionths of an inch.

Under the guidance of Dr. George Ellery Hale, who built the 100-inch telescope, leaders in many branches of science are co-operating with the International Education Board of New

York through a hole in the center of the giant mirror. A striking feature of the new telescope is that for the first time an observer



(Above) 3-winged rocket plane flies straight up like V-2 rocket. (Left) Jaeger P-13 plane that Nazis claimed could fly over 1500 mph.

GERMAN aeronautical engineering was much further advanced than our own at the end of the war in spite of that country's defeat. The Me-163 was the world's first successful rocket plane and it saw service against our bombers over Europe. Recently it has been revealed that to Germany, also, must go credit for developing the world's first supersonic fighter, the Jaeger P-13, which was under hurried construction before VE day. Had this plane been used early enough, the war may have continued many months

BY MARTIN CAIDIN

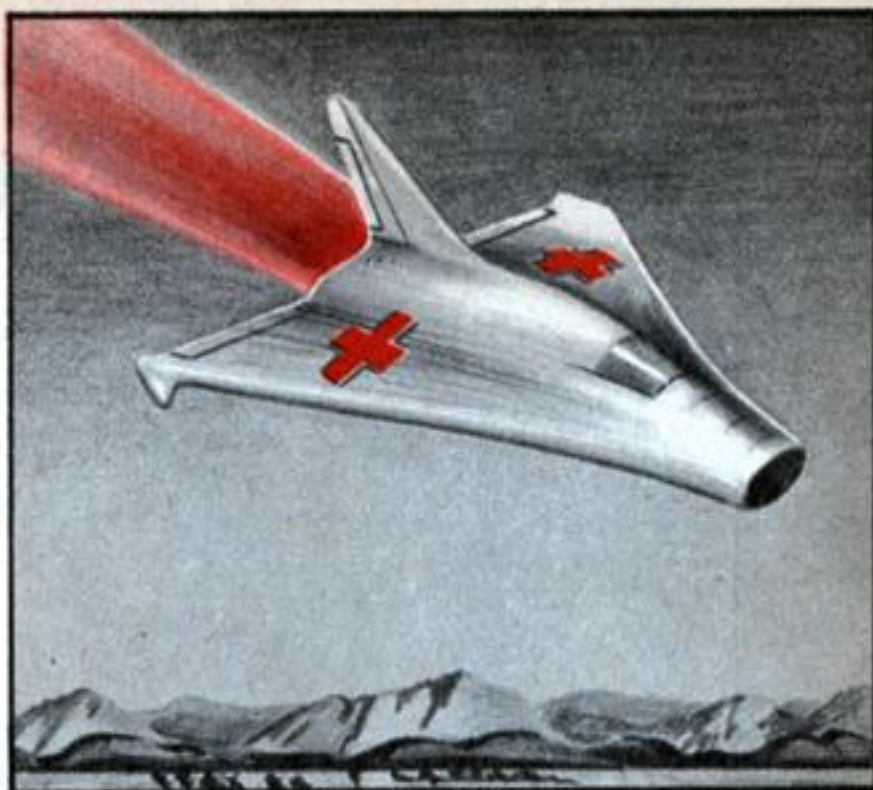
Two startling Nazi planes, faster than sound, threatened Allied air control at war's end.

longer, and might even have meant Nazi mastery of the skies over the Continent.

Powered by a revolutionary and advanced Lorin type ram-jet unit, a wind tunnel model had been tested and the prototype under construction when Nazi military might crumbled. Unlike any other fighter or aircraft in appearance, it was an all-wing design, with an extremely sharp taper commencing at the wing roots. A horizontal oval air duct provided the intake scoop at the machine's nose. Simplest and most efficient of all jet turbine designs, the ram-jet (or athodyd) powerplant uses the forward speed of the craft to produce air compression, therefore increasing in efficiency as the velocity increases.

The only protuberances of the machine were the single vertical fin and rudder, and a very low, streamlined cockpit canopy which flowed into the fuselage-wing contours. The cockpit was directly aft of the nose-intake duct, and had a very slight and rounded turtleback to the vertical fin.

Wingtips were turned down vertically; this seemed to add a substantial degree of stability. The Germans succeeded in discovering the solution to compressibility, something that has baffled our designers constantly with 500 mph-plus aircraft. Apparently a razor-sharp leading edge for the wing is not the answer. The 550-mph rocket-propelled 8-263 and Me-163B fighters were the first machines to utilize the German concept, an airfoil section with an unusually sharp sweep-back of entire airfoil and controls. [Continued on page 160]



Another view of jet fighter, showing all-wing design cockpit, and mouth of the ram-jet motor.

Triebflugel with athodyd jet units at the wing tips is single-seater, uses gas or liquid fuel.



Can We Ever Fly

A seemingly impassable barrier blocks the way to higher plane speeds. Can we hurdle it? Our aviation editor gives his views.

By C. B. COLBY

Drawings by STEWART ROUSE

DESPITE glowing newspaper reports, man cannot now fly at the speed of sound. In fact it is doubtful, according to the best authorities, that man has ever closely approached sonic speed (764 m.p.h. at sea level and 664 m.p.h. at 40,000 feet), let alone attain or exceed it. Speeds of over 500 m.p.h. in level flight are a serious challenge to design and power-plant engineers. Even in a terminal-velocity dive (straight down with all stops open), it is doubtful that any pilot has attained the speed of sound.

There are two reasons for our inability to hit the speed of sound with present-day aircraft: First, the lack of power; and, second, a little gadget called a Mach (pronounced mock) number. The second reason is the more important, for it is responsible for the first, and so, let's delve into this Mach business.

It is merely for convenience that there is such a thing as a Mach number. It represents the relation of any speed to the speed of sound. For example a Mach number of .5 means that the speed so described is 50 per cent of the speed of sound.

The importance of the Mach numbers is that when an object begins to climb the speed scale up toward the speed of sound, many things can happen; the Mach numbers indicate at what point on this scale various things can be expected. For example, when the Mach number of a plane reaches .5 we run into what has been called compressibility.

Compressibility is that point at which an object begins to make waves in the medium through which it is passing. A boat moves

SHARP, THIN WING EDGES

MADE OF CAST STEEL AND RAZOR-SHARP

TWIN-CHAMBERED
ROCKET ENGINE
CONTINUOUSLY
FIRES AN
EXPLOSIVE
MIXTURE OF
FUEL AND
OXYGEN BY
ELECTRIC
IGNITION

OXIDIZER

OXIDIZER

OXIDIZER

SPOILER

SPECIAL SPOILER-TYPE CONTROLS FOR SUPERSONIC SPEEDS

ORDINARY RUDDER, ELEVATOR, AND AILERON CONTROLS WILL NOT WORK IN EXTREME AIR TURBULENCE BEHIND SHOCK WAVES PRODUCED AT SUPERSONIC SPEEDS---



SHOCK WAVES

SO SPOILERS ARE USED AS CONTROLS. THEIR DAMLIKE ACTION PRODUCES SHOCK WAVES TO DESTROY LIFT AS AILERONS OR CAUSE WING-TIP DRAG AS A RUDDER

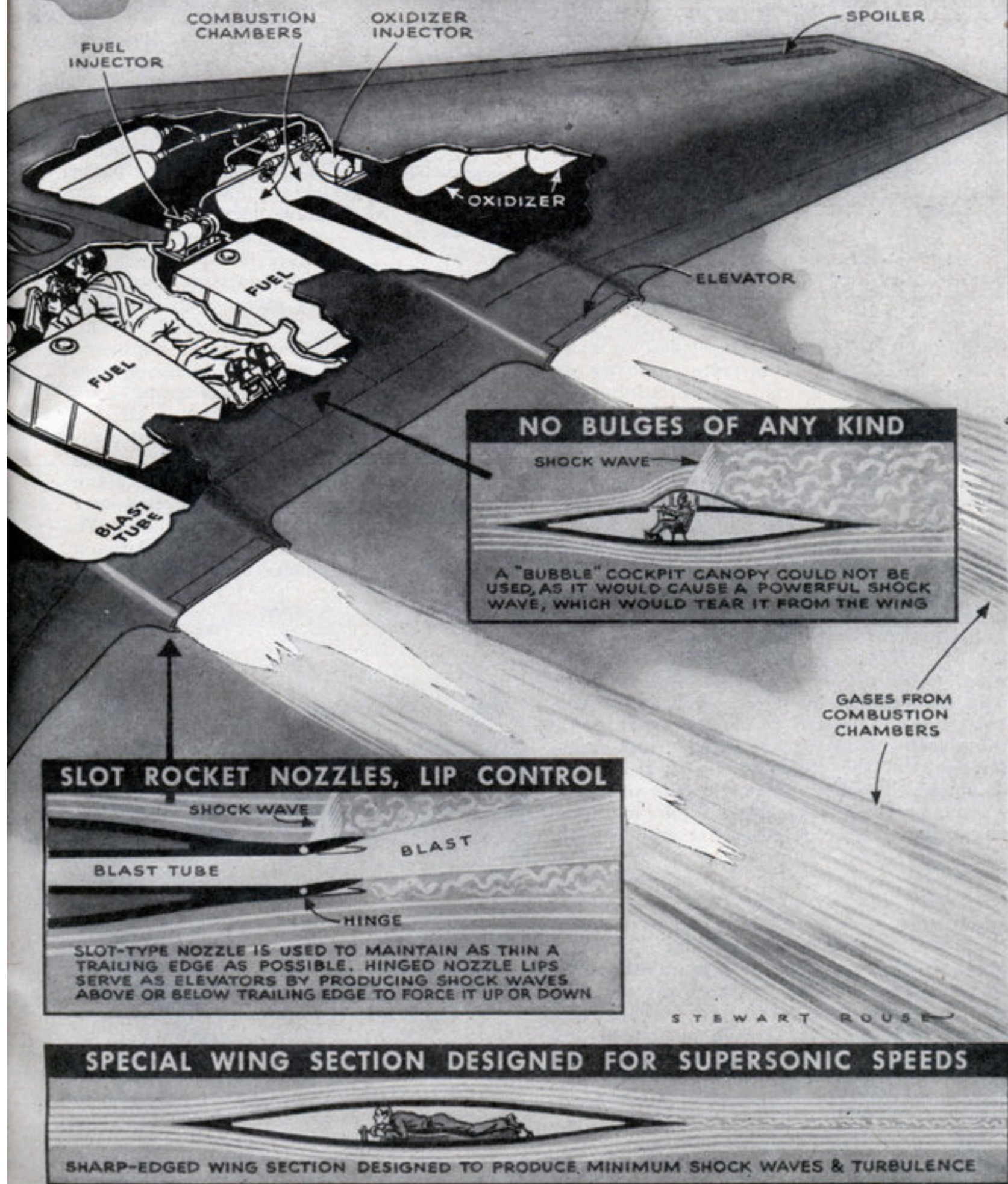
SHOCK WAVE

TURBULENCE

AS AILERON—TURBULENCE DECREASES LIFT

AS RUDDER—TURBULENCE INCREASES DRAG

Faster than Sound?

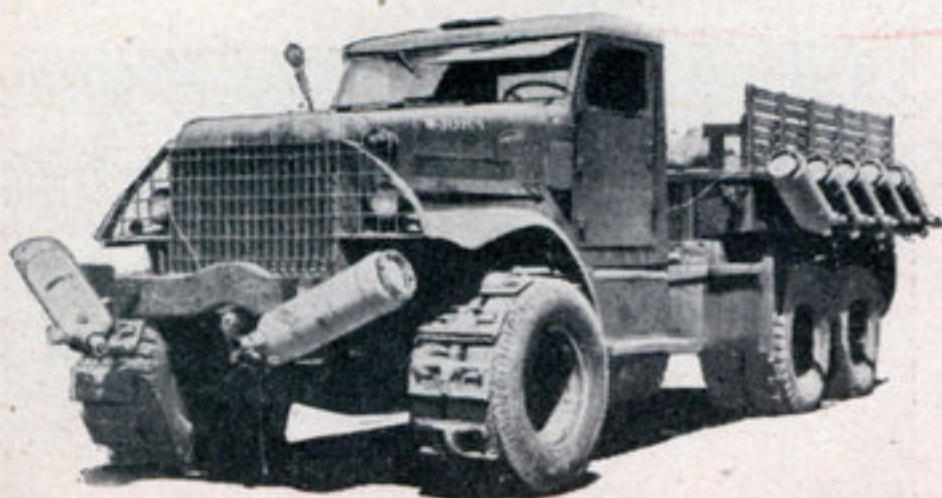


SUPERSONIC PLANE? Nobody has ever seen an airplane capable of equaling the speed of sound. However, we asked staff artist Stewart Rouse to give us his conception of such an aircraft, based on the aerodynamic problems involved. Taking a modern plane, he eliminated the features that would bar supersonic flight. Flying-wing design was adopted to solve the turbulence problems presented by a tail. A jet engine removes propeller worries and gives the needed power. Cockpit bulge is eliminated by putting the pilot inside the wing; prone position helps him stand maneuvering strains. Turbulence, chief foe of supersonic flight, is harnessed for control. Rouse admits one flaw; this plane could maintain flight **ONLY** at or near sonic speed. He doesn't say how you would get the thing off the ground or bring it down again



Mired in axle-deep mud for Army test shown on cover, a "six by six" weighing 36,000 pounds was boosted to firm ground by 12 JATO units

Five jet-assist units were put on each side of test truck and two more were angled downward in front to blow mud out of the path



The folks who helped "jet" heavily loaded planes out of tiny New Guinea airfields are now busy finding more homely uses for JATO units. Such as boosting tired trucks out of mudholes and up steep roads, or putting emergency brakes on runaway mine cars

WHAT we want," the public-utilities official stated, "is an auxiliary engine that will help our construction trucks and trailers climb up into the mountains. The loaded vehicles weigh 33 tons and right now we grind along at six miles per hour. We want to get up those grades at 45 miles per hour."

The Aerojet engineer thumbed his slide rule for a moment and grinned.

"We have just the thing," he commented. "Five hundred horsepower in a package 18 inches square. How's that? Turn the auxiliary power on at the foot of the grade and cruise along as fast as you want. Only trouble is, you can't afford it. At \$2.50 per gallon, fuel will cost about \$1200 per trip."

The compact motor the engineer described is a lightweight rocket-driven turbine, comparable to the turbine that drives the fuel pumps of a V-2. It uses Diesel oil plus a liquid oxidizer as fuel. It makes relatively little noise and needs no muffler. It's cooled internally by steam in the rocket chamber. It produces 500 horsepower at 30,000 revolutions per minute.

As a booster engine for a truck, the turbine would be connected to the vehicle's drive shaft by a fluid coupling that would also serve

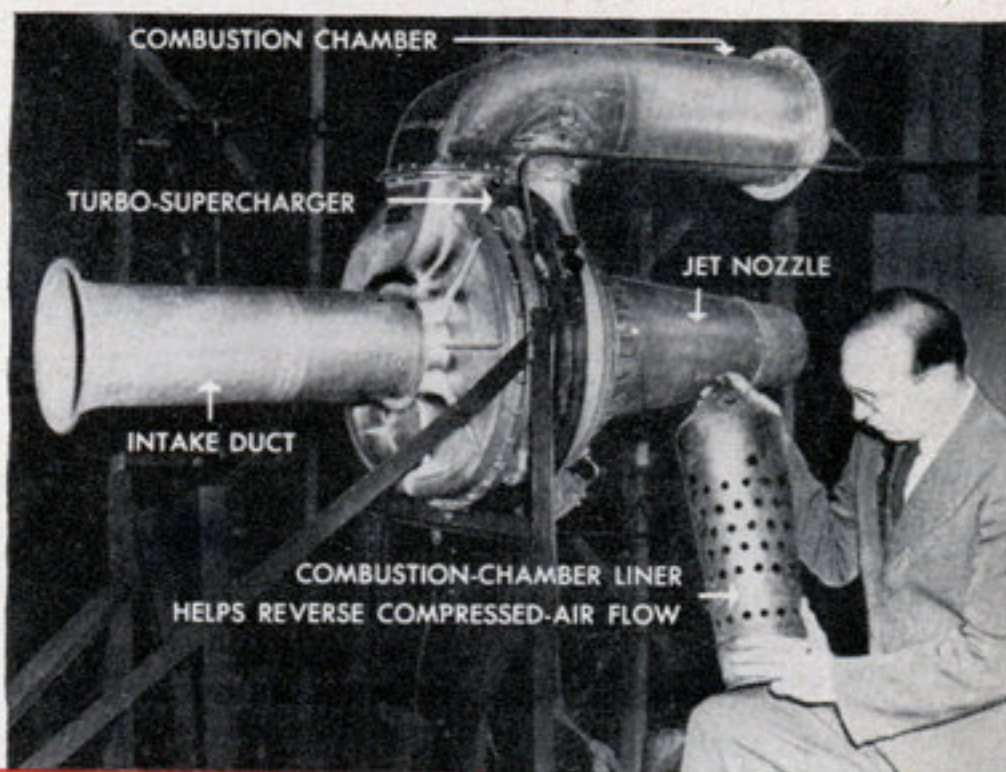
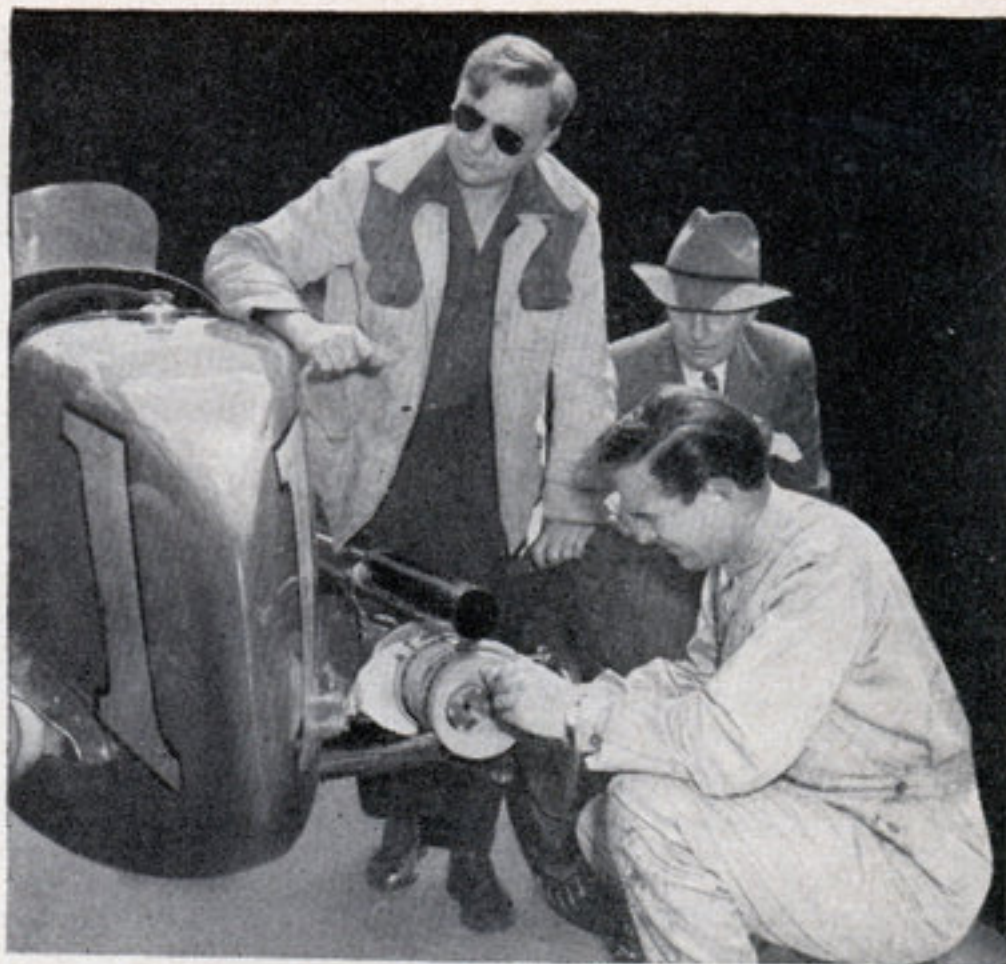
Gets
**LOOK
FOR
JOBS**

as a gear-reduction device. The idea is entirely practical, except for two things—the present high cost of the oxidizer and the size of the tanks that would be needed.

Emergency rocket brakes for runaway mine cars, rocket-powered posthole diggers, rocket-driven surfboards for lifeguards, rocket-type remote-control fire extinguishers; all these, plus the auxiliary rocket engine for trucks, are among the unique ideas that have sprung out of research in rockets, guided missiles and gas-turbine studies.

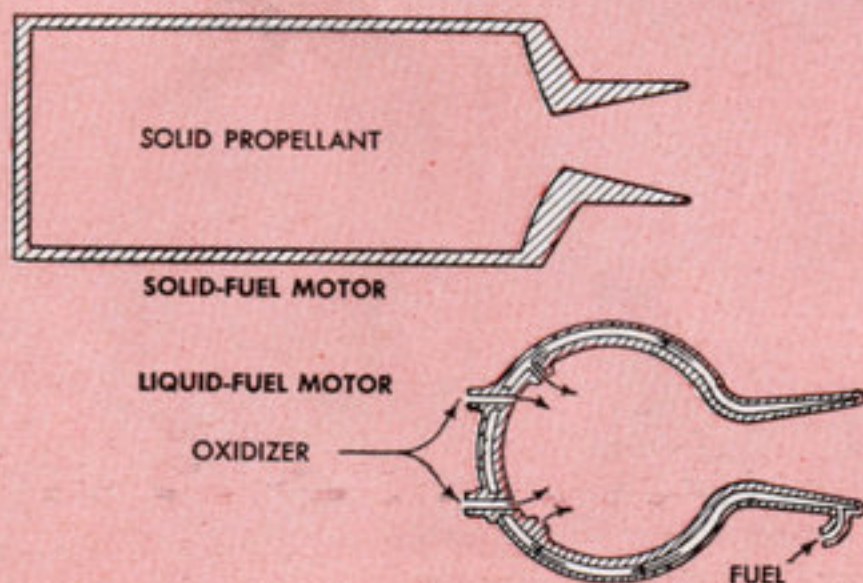
Looking into the future, Aerojet Engineering Corporation of Azusa, Calif., has been giving serious study to some of these ideas. Dr. F. Zwicky, Dr. Theodore von Karman, and other scientists on the staff know that a device that seems worthless today may suddenly become important and practical tomorrow. Aerojet, a subsidiary of The General Tire & Rubber Company, manufactures jet-assisted take-off units in various sizes. It built the Navy's Aerobee sounding rocket that recently climbed 80 miles into the stratosphere.

Aerojet's JATO units are standard equipment for helping heavy aircraft up into the air from small fields. The units shorten the take-off runs of jet aircraft and assist very heavily loaded planes in

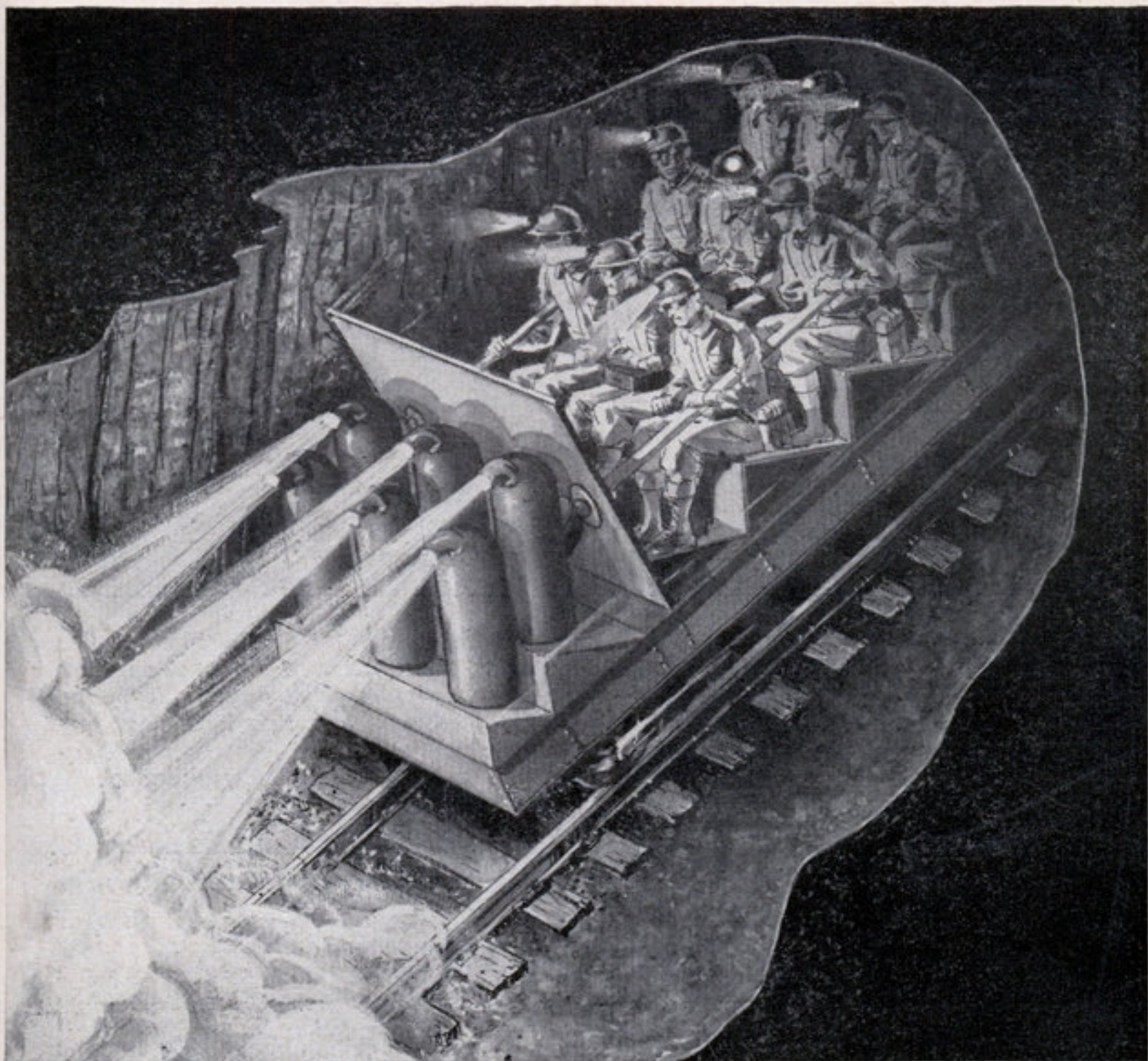


Racing driver Duke Nalon, top, tests additional thrust given by rocket motor at rear of car

Above, war-surplus supercharger and ducting are converted into gas turbine for drone plane



Simplified drawings of two main types of rocket motors. The one above uses solid propellants, as in the case of the JATO units, and the other runs on liquids. Excessive cost of fuel is the bugaboo of rocket development



Emergency rocket brake has been tested for mine cars on steep inclines; it works automatically if cable snaps. One blast would be adequate to halt a fully loaded car on a 30-percent slope after 7.6 seconds of deceleration

oxygen during the 20 seconds or so that its motor is operating.

For their rocket interceptor planes the Germans devised a different fuel consisting of hydrazine hydrate, methyl alcohol, and water and potassium cuprocyanide. They used an 80-percent concentration of hydrogen peroxide as the oxidizing agent. Even this fuel was inefficient from the weight standpoint. Two tons of it produced only three minutes of powered flight.

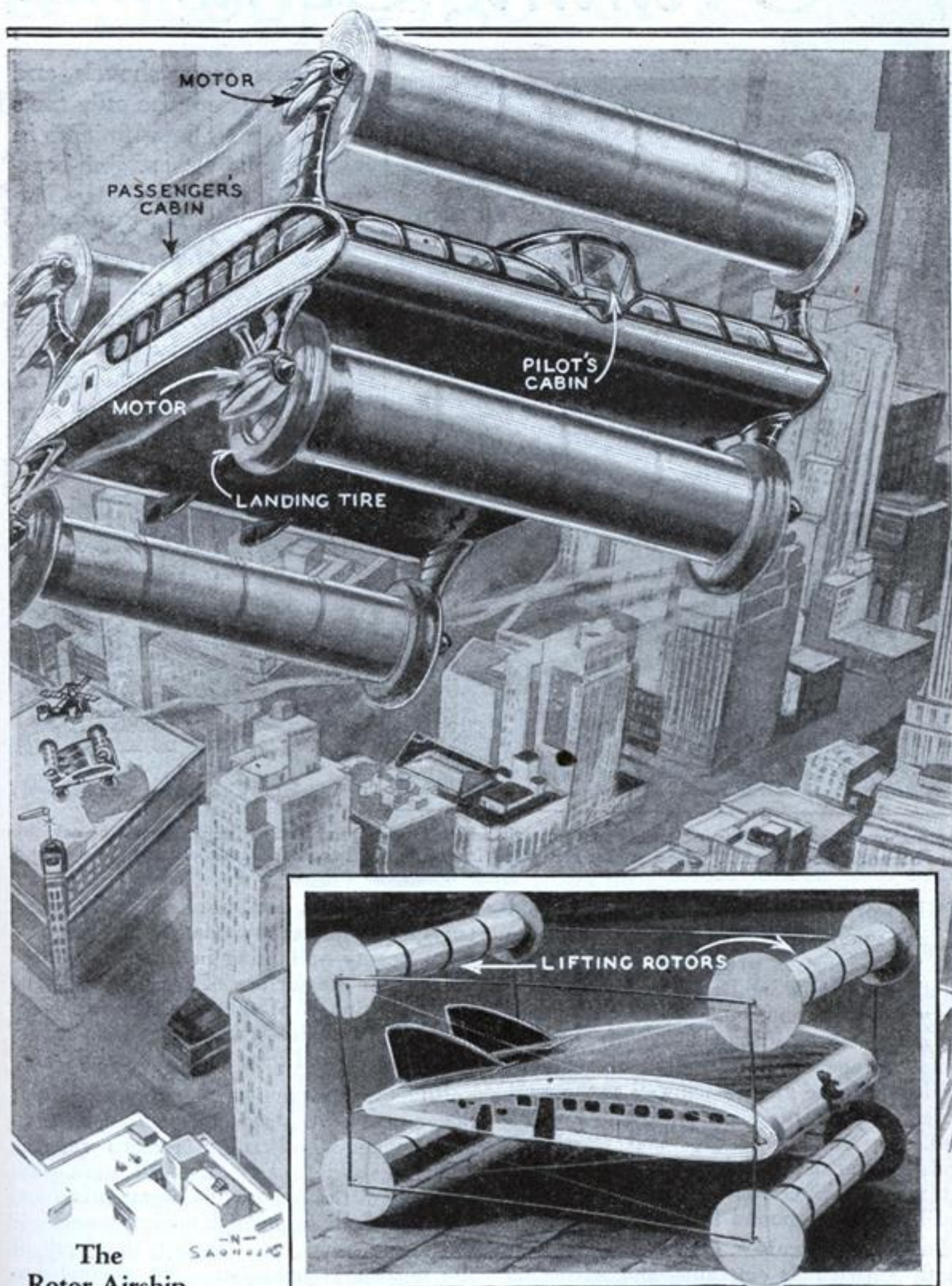
Rocket-fuel research is of such scope that major portions of it have been "farmed out." Cal Aero Technical Institute of Glendale, Calif., for instance, is engaged in a big program of testing German rocket and gas-turbine engines for Wright Field, especially to improve upon the original combustion chambers.

An interesting sidelight on gas-turbine

research is the building of small gas turbines from surplus turbo-superchargers. The superchargers were used in nearly all American bombers and in many fighter aircraft during the war and since then it has been discovered that the superchargers can easily be rebuilt into gas turbines.

The original superchargers consisted of a drive shaft to which was attached a turbine wheel and a compressor. Conversion consists principally of adding sheet-metal ducting. Air from the compressor is led to a simple firebox where kerosene or other jet fuel is burned, and the combustion gases are ducted back to the turbine wheel and from there to an exhaust nozzle. One converted turbo unit has enough power to fly a small plane of the drone type, and two of the small gas turbines provide enough power for a one or two-place light plane.

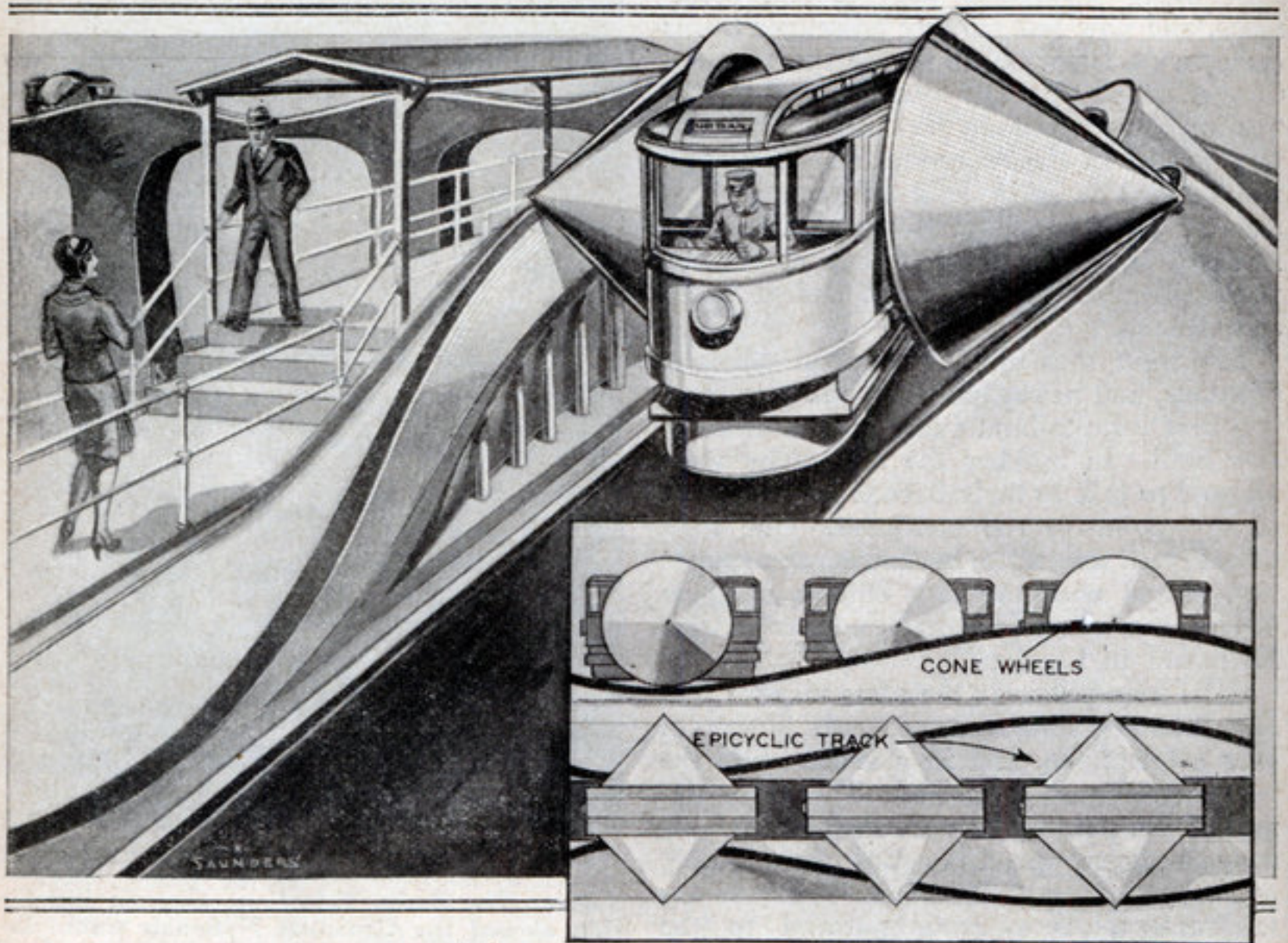
The FREAK of the Month ~ No. 3



The
Rotor Airship

The oddest contraption which has been brought to our attention this month is the rotor airplane designed by Ernst Zeuzem, of Frankfort-on-Main, Germany. The inventor's model is shown in the inset, while above is an artist's conception of how the full-size plane would appear in the air. Each of the four rotors will be driven by separate motors which need not be of exceptional power. The passengers will be carried in the wing section. In spite of its odd design, the principles of this plane are sound.

Can Trains be Run



This shows how an idea propounded a hundred years ago for the propulsion of railroad trains might look as applied to a modern railway. Cones that run up or downhill by gravity are the underlying principle.

by HJALMAR LUERSSEN

OF ALL the mechanical brain-bugs that repeatedly surge over the country, the perpetual motion bug holds all records for depth and duration of sting. The perpetual motion idea has been recurring in cycles and minor cycles for over a thousand years, or since the birth of scientific thought, and magazine editors have recently noted that the virus has again affected inventors.

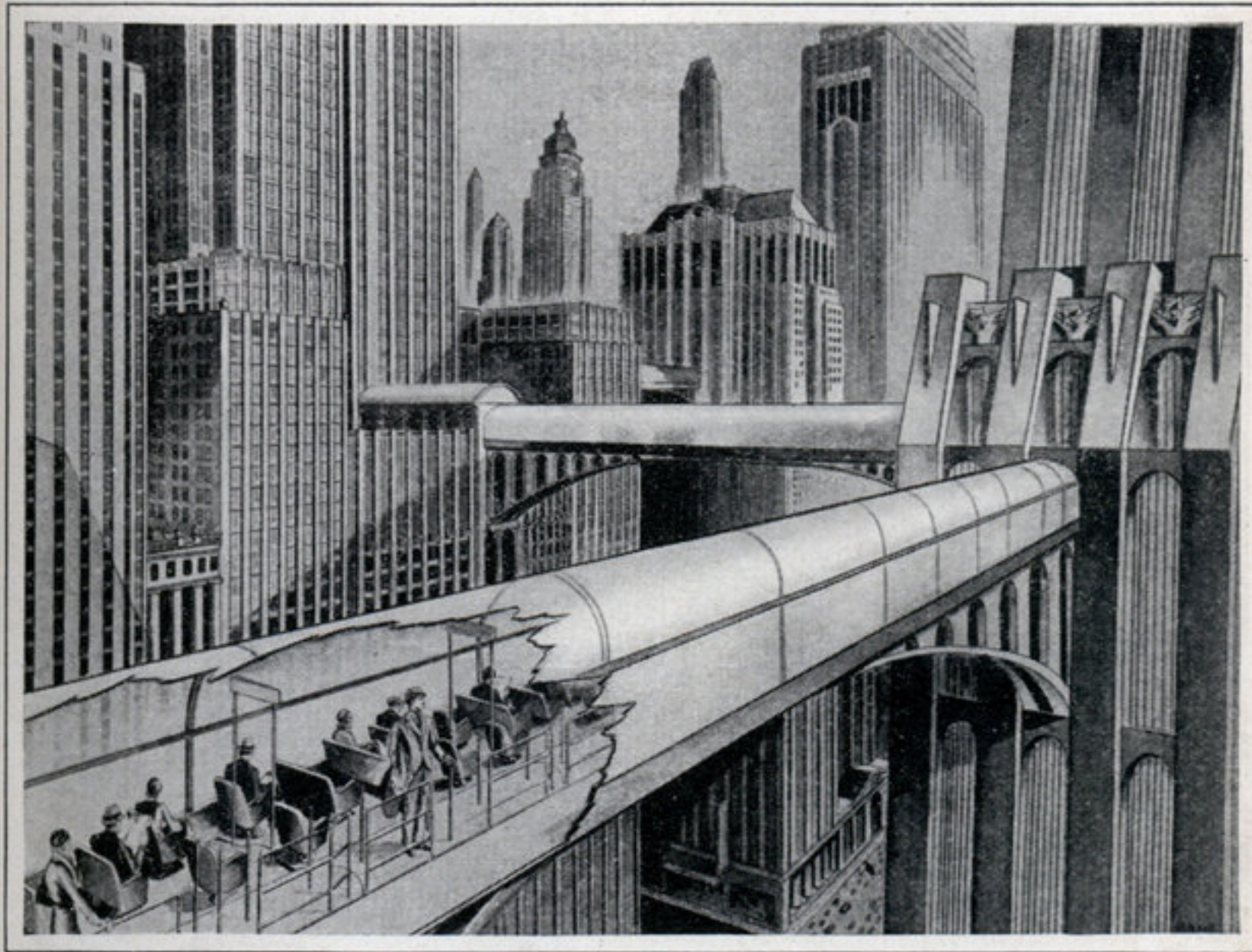
Thus it is we have at present a wave of all manner of hare-brained schemes for extracting power from nothing. Among these schemes is a fantastic idea for running a train over an epicyclic track, using cones attached to the sides of cars instead of the regular flanged railroad wheels. Gravity is supposed to furnish the power and keep the train running on the level.

Will it work? Will gravity run such a railway?

Let us see. Let us revert to a familiar form of illusion called the "cone and track" experiment, familiar to all students of high school physics. In this device a cone will appear to roll uphill when placed on a track which runs uphill and diverges outward. The coned wheel will move toward the high point on the track and the tips of the cones will be resting at the highest point on the track when your hand brings it to rest.

In reality, however, the center of gravity of the cone fetches up at the end of the track in a lowered position. Hence the cone really runs downhill while appearing to run uphill.

Endless BELT TRAINS for Future Cities



Cities of the future may see the inhabitants transported on this endless belt system, which has recently been developed in Westinghouse laboratories. Passengers board slow-moving local belts, then step to faster belts, reversing process for exit.

TRANSPORTATION of city inhabitants through subway or overhead tubes on endlessly moving belts, providing more speed and comfort than our present systems of passenger service, loom as a possibility, according to Norman W. Storer, engineer of the Westinghouse Electrical Co., who has developed the idea.

As described by Mr. Storer, the system is an arrangement of continuous trains or belts of cars, running on parallel tracks. There is a stationary loading platform along the entire course of the system.

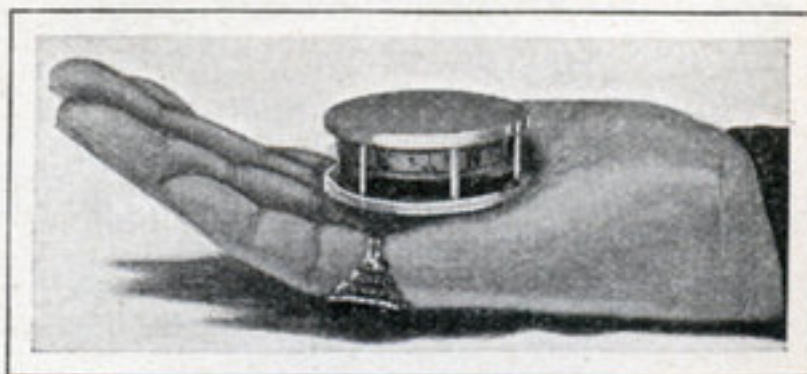
Passengers board the first local train at any point, and it stops every 50 seconds for a period of 10 seconds. When the doors close, a gong sounds and the local platform starts moving. Now there is another signal and gates open for a second platform, or express, on which the passenger takes the major part of his trip. After ten seconds the gates close and the local slows down for another stop, while the express picks up to a 22 m.p.h. speed.

Noise of the system is at a minimum, and passengers are delivered at no more than 300 feet from their streets. All stations are controlled from one central point, all elements being so timed that there can be no hitches.

Plane Type Compass for Hunters

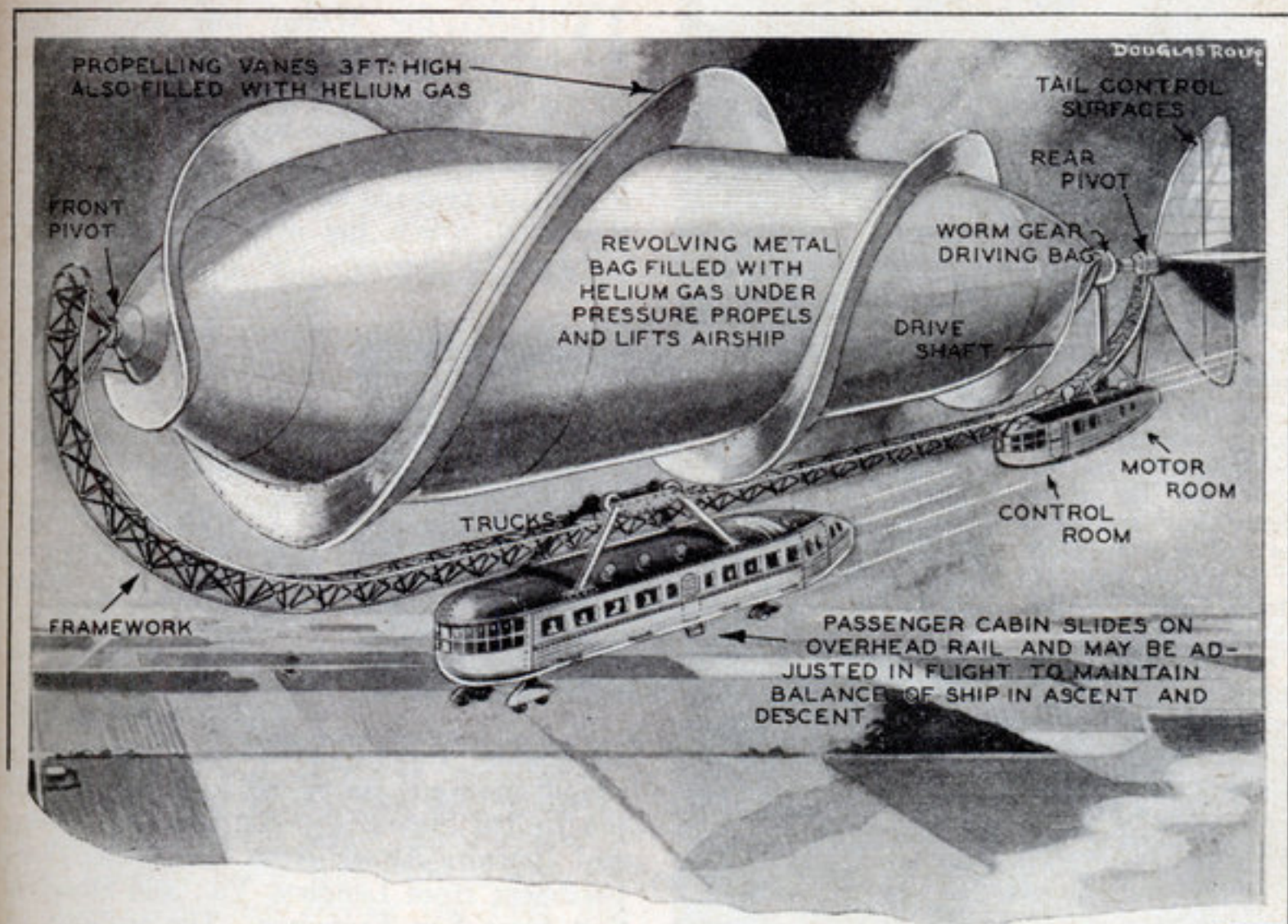
IDEAL for hunters, hikers, Boy Scouts and even aviators whose regular instrument has failed, is a direct reading, oil pocket, airplane type of compass now on the market. So small that it can be held in the palm of the hand, as demonstrated in the above photo, the compass yet proves amazingly accurate. The pivots work in an oil pocket, providing the utmost in flexibility. One outstanding advantage is that it reads the way you are looking, which means that it points out the direction in which you stand.

It will stand the roughest usage without impairment of its accuracy.



Last word in accuracy and convenience is found in this pocket compass, so small that it can be held in palm of hand. Pivoting in oil pocket, it has minimum inertia.

Proposed Rotary "Aero-Zep" Uses Novel Screw Vanes



Revolving spiral vanes on the gas container of this novel dirigible are designed to propel it forward through the air. The entire gas-shell revolves around the stationary track framework of aluminum.

A MOST unusual type of dirigible involving wide departures from established principles has recently been patented by two South Dakota inventors. They call it the "Rotary Aero-Zep," and aside from the fact that the entire craft is designed to be constructed of aluminum, the most novel feature of the invention is the metal gas bag which is designed to revolve around the frame trackway carrying the passenger car, screwing the airship forward in the air through the action of spiral vanes mounted on the side of the bag.

These vanes, three feet in height, are V-shaped and hollow, and are themselves filled with helium separately from the gas bag. The passenger cabin is suspended from a track running beneath the ship, being mounted on trucks which are free to move along the track to keep the weight of the ship balanced as the angle of ascent or descent varies. The track framework, curving upward at either end, supports pivots on which the bag turns freely. To call the gas container a bag is somewhat of a misnomer, since it is to be of corrugated aluminum.

A motor cabin, mounted permanently at the rear of the trackway, contains engines which will drive the revolving bag. Tail control surfaces are of conventional design, except that each of the four sections is separately controllable—that is, the right half of the elevators can be controlled independently of the left, and the top section of the rudder independently of the bottom, in contrast with usual practice in which both sections of rudder or elevator are operated together.

Seven hundred miles an hour is the rather incredible speed anticipated from the craft by its inventors, Rev. Carl H. Looch and Lorrin L. Hansen of Rapid City, South Dakota. The bag itself, through its novel drive, will revolve comparatively slowly even when the ship is traveling at top speed, the inventors believe. A safety valve at the end of the body is provided in case gas pressures are built up to a dangerous degree. As yet this amazing new idea in aeronautics has not progressed beyond the model stage, and it is not at present known when a full size ship will be built.

President Gets New Convertible

THE man in the White House took delivery the other day of a specially built seven-passenger Lincoln convertible with disappearing steps on which Secret Service men ride like footmen. Last of 10 cars built for Mr. Truman, his family, and distinguished visitors, it has a 145-inch wheelbase compared with 125 on the Lincoln Cosmopolitan. It has an over-all length of 20 feet compared with the standard 18½.

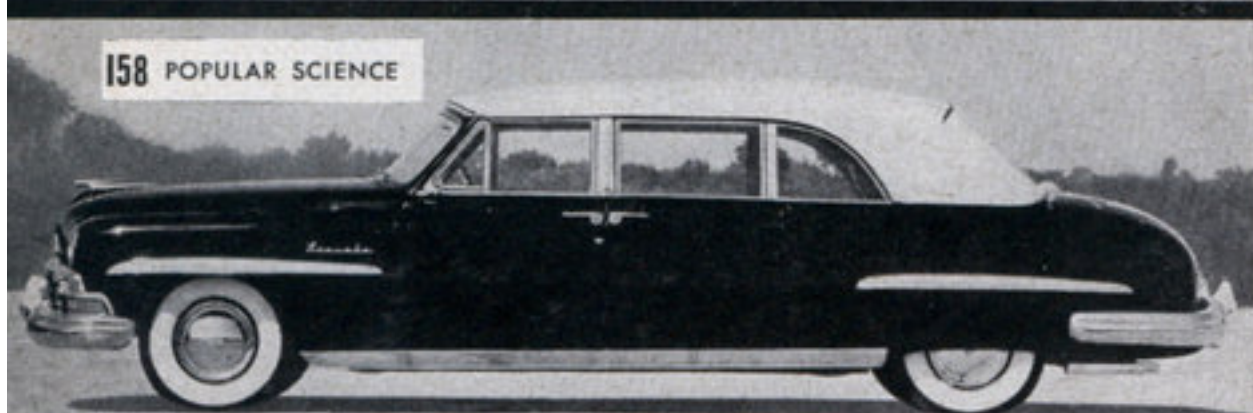
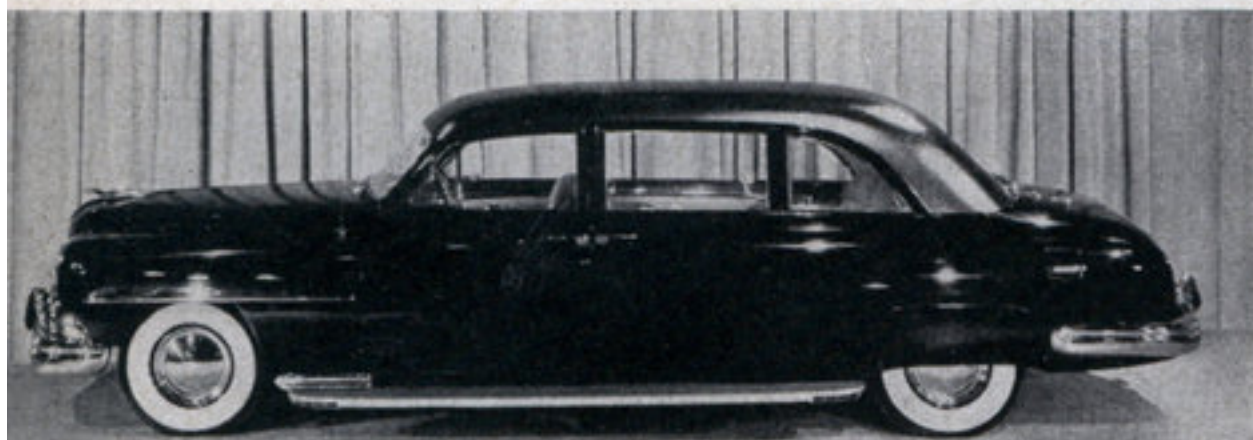
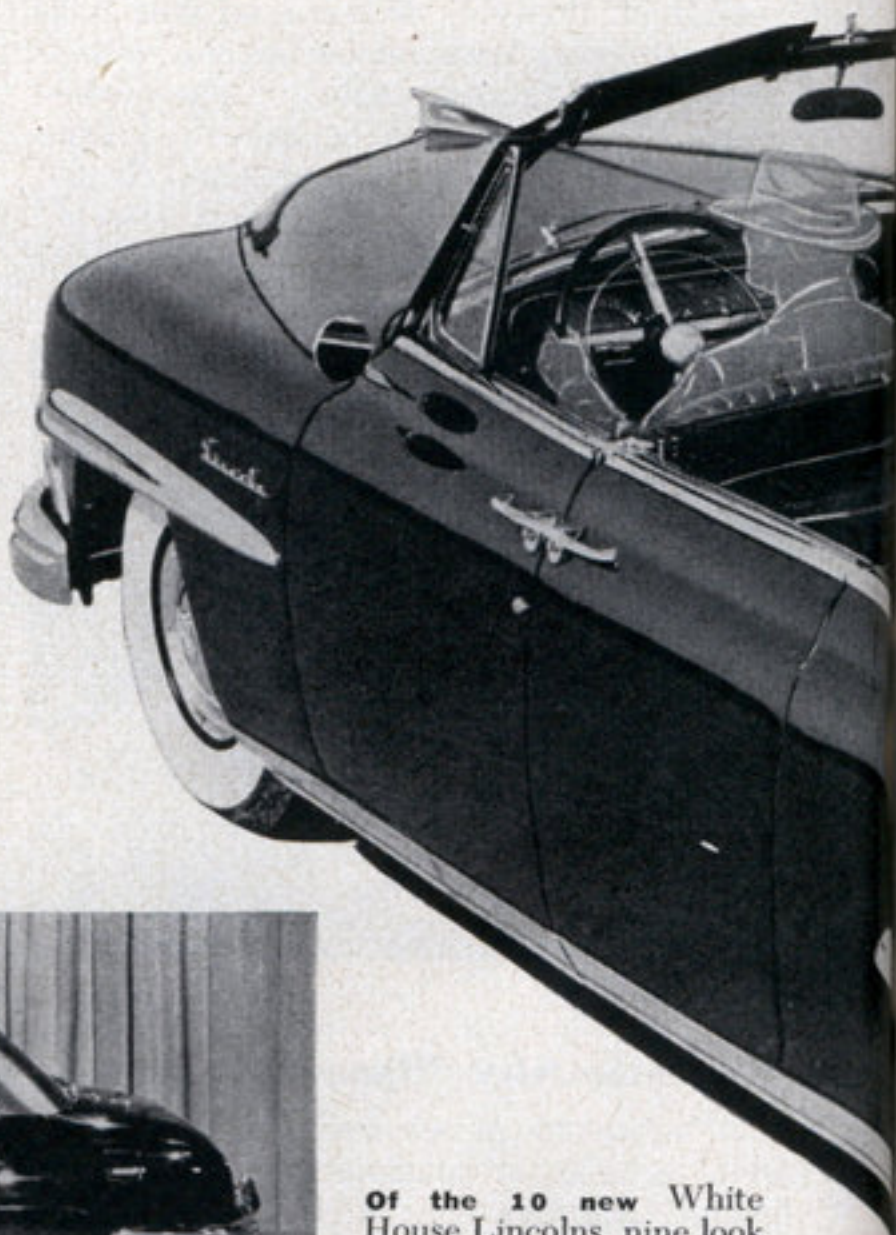
The other nine cars are limousines. Four of the nine, used by the First Family itself, have gold-plated fittings. The remaining five, with chrome substituted for the gold plate, are for distinguished visitors.

The cars have the regular 152-hp. V-8 engines, with heavy-duty Hydra-Matic transmissions. Their curb weight ranges from 6,100 to around 6,500 pounds—some 1,700 more than the regular Cosmopolitan. Special equipment on the convertible includes a warning siren and a flashing red light. All cars have an extra rear-seat heater. Coal-black, the convertible has white sidewall tires, red-and-black leather upholstery, a tan top, and two jump seats.

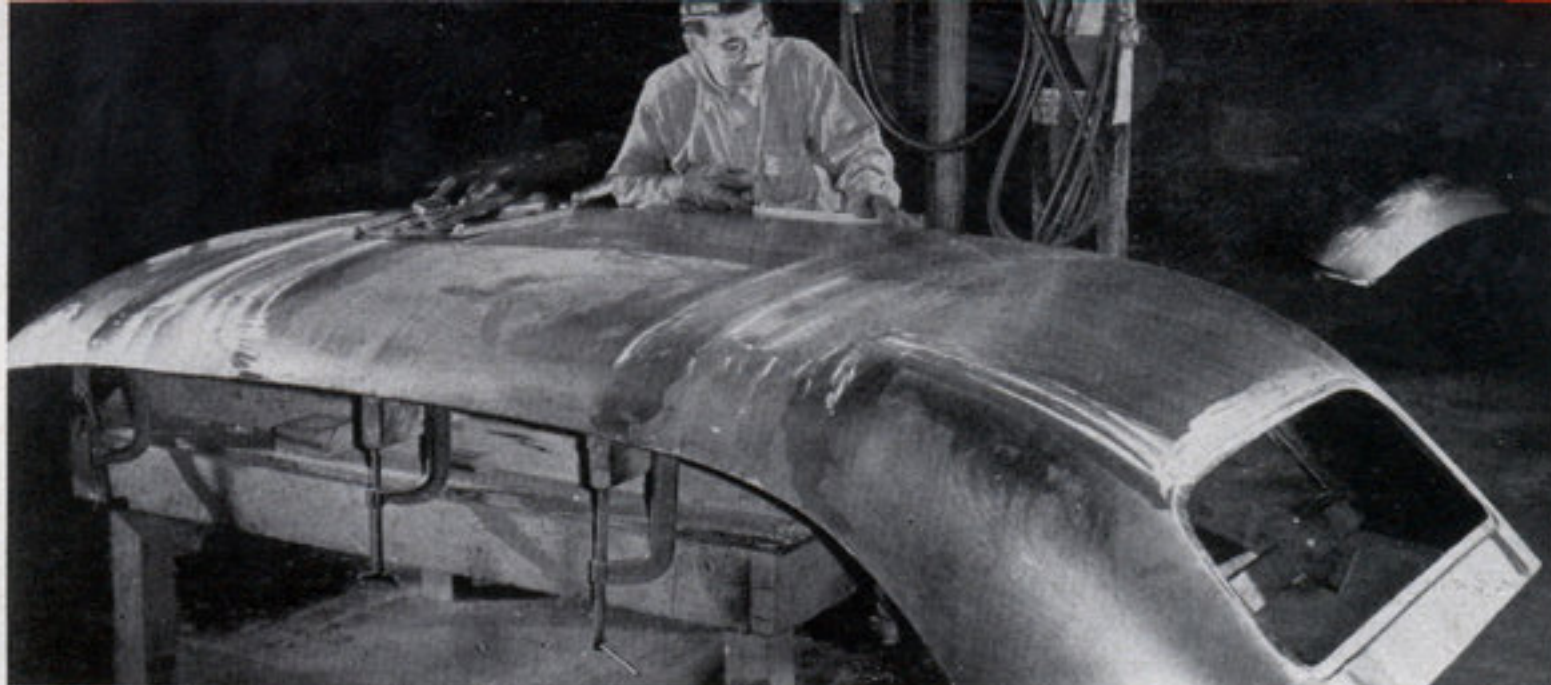
To strengthen the extra-long frames, a cap of ¼-inch steel was welded to the longitudinal members and crosspieces. Limousine

tops have one regular top and part of another welded together. Lengthening drive shafts required adding a universal joint.

The convertible body was built by Dietrich Creative Industries, Inc., of Grand Rapids, Mich., the limousine bodies by Henney Motor Co., of Freeport, Ill.

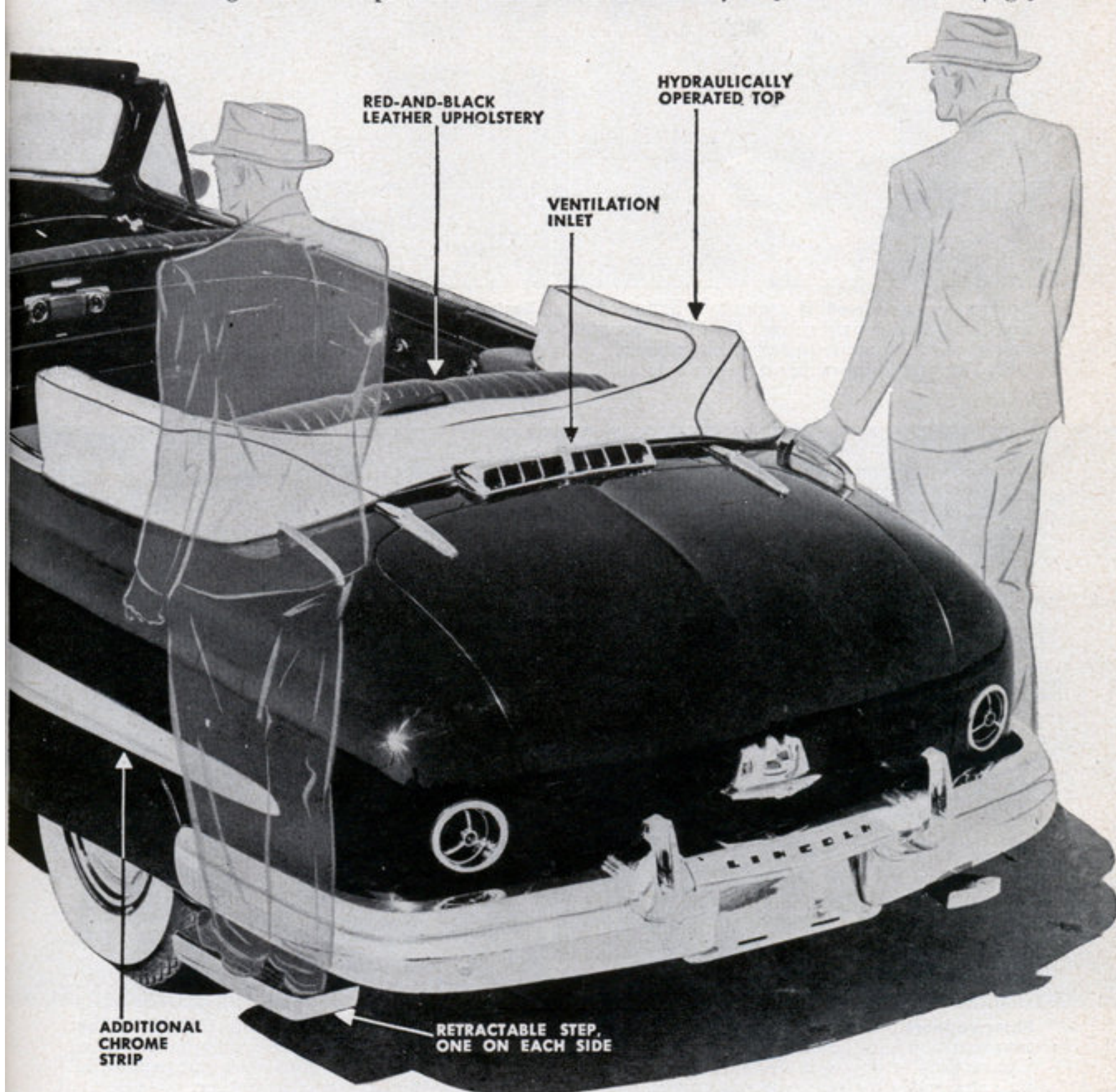


Of the 10 new White House Lincolns, nine look like top car at left. Lone convertible is for parades and reviews. Rear-compartment heating and ventilating units are controlled by passengers. Passengers can talk to driver through microphone. Convertible's king-size top is hydraulically operated. Cars are leased to government by Ford Motor Co. at "nominal sum."

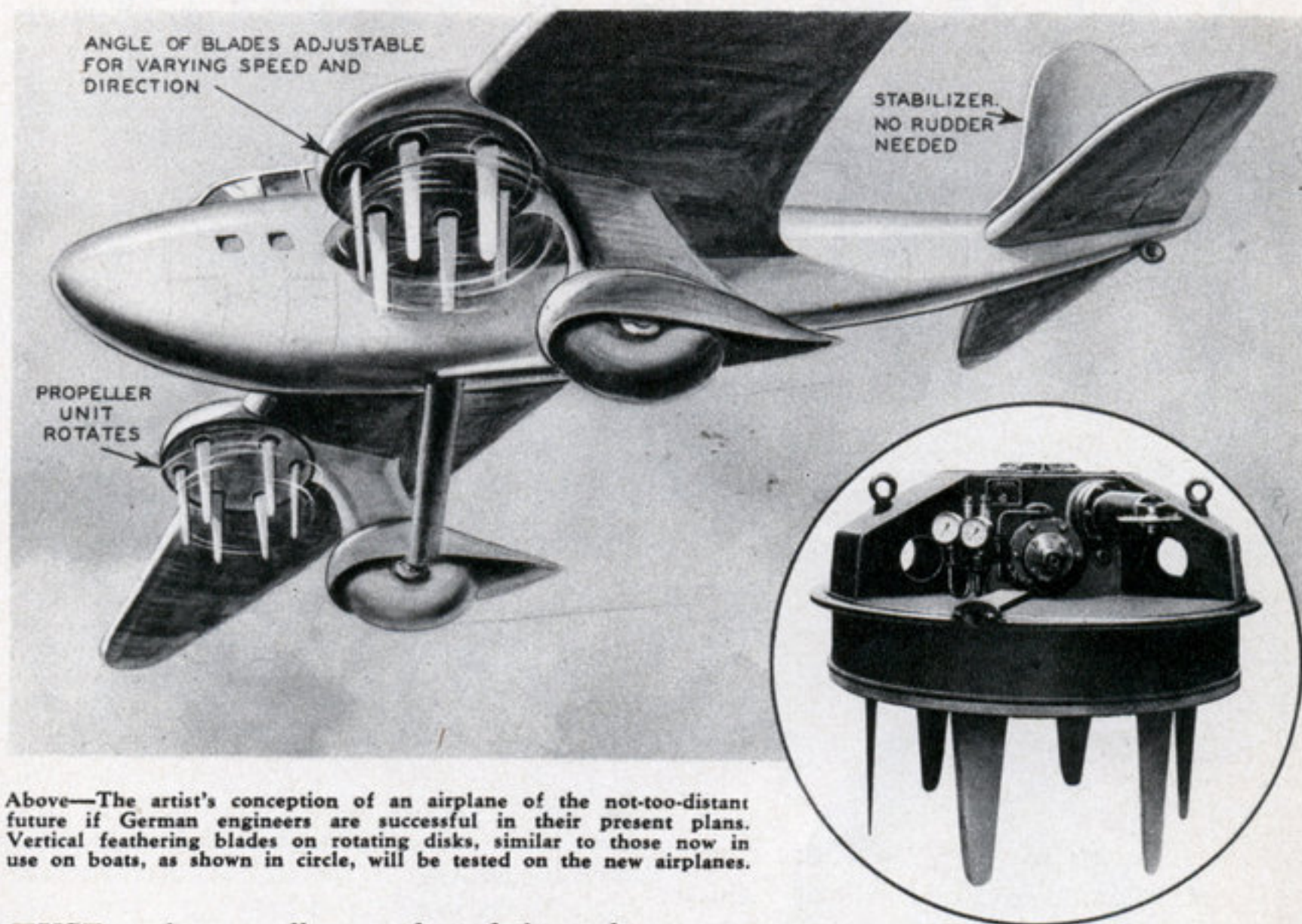


In manufacture, workman files down seams where extra-long limousine tops were welded

together. Convertible's steps (below) extend, retract manually. [Continued on next page]



Rotating Blades To Row Planes In Air



Above—The artist's conception of an airplane of the not-too-distant future if German engineers are successful in their present plans. Vertical feathering blades on rotating disks, similar to those now in use on boats, as shown in circle, will be tested on the new airplanes.

JUST as the propeller supplanted the paddle wheel, revolutionizing shipping, so are the new Voith-Schneider vertical feather-blades, successfully tested in Germany, expected to supplant the propeller.

The blades, mounted on a rotating disk, have been used for the past two years on river and harbor boats with marked economies in operation coupled with a decided increase in maneuverability. As the disk rotates, the blades present a full face on the back stroke, and then assume a feathered position for the return circuit. Steering is accomplished by an adjustment which delays the feathering movement, the open faced blades thus pushing the stern of the vessel to starboard or port as desired.

The next step now being attempted by German engineers is the adaption of the vertical feathering blades to aircraft. Among the advantages claimed for the Voith-Schneider system is that it will permit greater streamlining, all motor mountings being concealed within the plane, and that it will eliminate rear rudder steering. The blades for aircraft will be larger and of much lighter construction than those in use on boats. Steering will be accomplished the same as in boats.

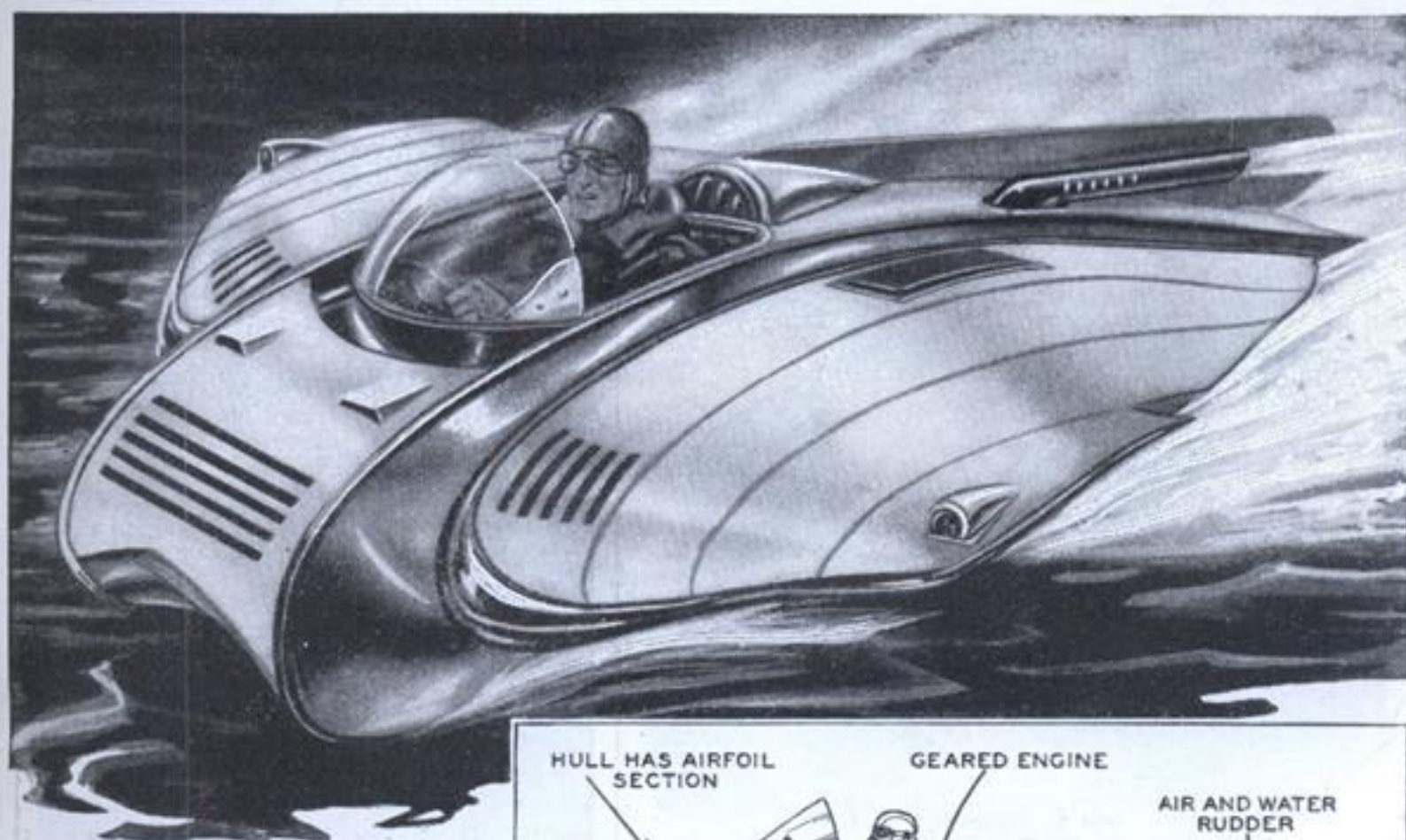
Metal Firm Devises Ideal Workshop

THE rapid increase in the numbers of persons adopting a metal working hobby has inspired one manufacturer to come out with a complete line of metal working tools designed to meet the needs of the home workshop. Included in the list of equipment is a metal former, combination pan and brake box, accessories for spray painting, bending, forming, punching and working flat stock.



Everything the home work shop fan needs for working metal is included in this line produced by one manufacturer. All tools are capable of working metals up to 1/20" thick.

Airplane Influence in Speed Boat



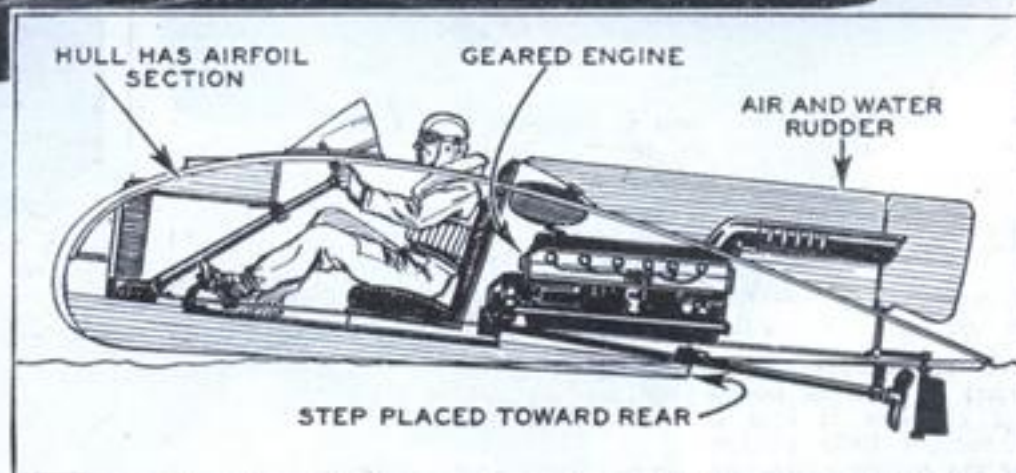
Spray deflectors of airfoil section serve two purposes; give lift and keep boat free from flying spume and water.

SPEEDBOATS have for many years been the subject of attack by inventors. Many of the so-called "solutions" are merely brainwaves such as wheels in water for the boat to run on and so on. The readers of *MODERN MECHANIX AND INVENTIONS* will immediately recognize something rational in the above solution, which is a development of existing elements, put together in a new way so as to achieve new comforts, new speed and utter dryness.

The hull is of a thick wing section above the water, and has a flat bottom with step placed far to the rear in accordance with the new thought in hydroplaning surfaces.

Instead of a cockpit in rear of a roaring motor, the motor is placed just abaft the step, and is geared to the propeller. The exhaust pipe is louvered to induce extra speed of exhausting the hot gases, with some idea apparent in an attempt to speed up the air behind the boat. Whether this is awry or not hasn't been proven, but it would seem to us that this element is not practical.

Certainly the matter of having the passengers forward in a deep, well faired cockpit, out of the way of noise, is a distinct advantage. Another thing designed to serve a twofold purpose is the brace of small spray wings on either side of the hull, which serves to kill off flying spume and water,



Here's a section through the novel speedboat built by a New York inventor, giving an idea of the new arrangement. The fore plane is long, the step section short, and the flatter forward plane is considerably less bumpy.

and at the same time help not only the air resistance by more gently opening and closing the flow of air, but possibly obtaining some planing lift by a wind action.

Some years ago Dr. Alexander Graham Bell experimented with a speedboat which had hydrofoils or steel stepladders on the bottom of the hull. It was a large boat, nearly eighty feet long, and had for power two 450 h.p. Liberty motors. Amazing speeds were attained, some in excess of 80 miles an hour, and from that time on, inventors have been trying to adapt airplane principles to speedboats, but with little success. It must be remembered that the medium, air, which airplanes depend upon is 1/800th the weight of water, and that an airplane goes through the medium, whereas a boat goes over the surface. Hence any improvement should take into account the two factors—air through which the boat goes, and water on which it rides.

This boat seems to have been an intelligent attack, capable of comfort and real speed, and is, as you will agree, very stylish and striking in appearance.

Super-Speed Turbo-Plane to Span Ocean

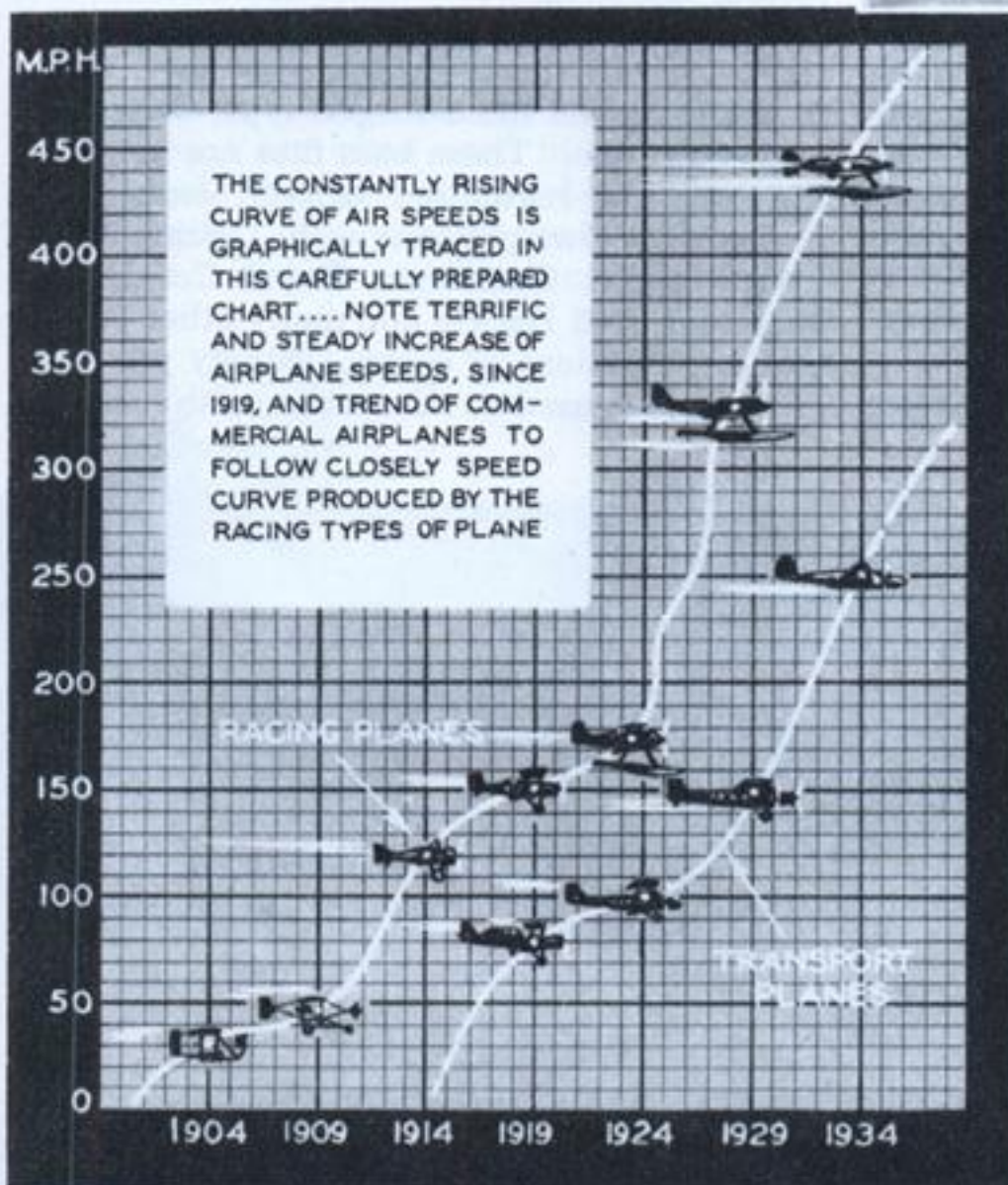
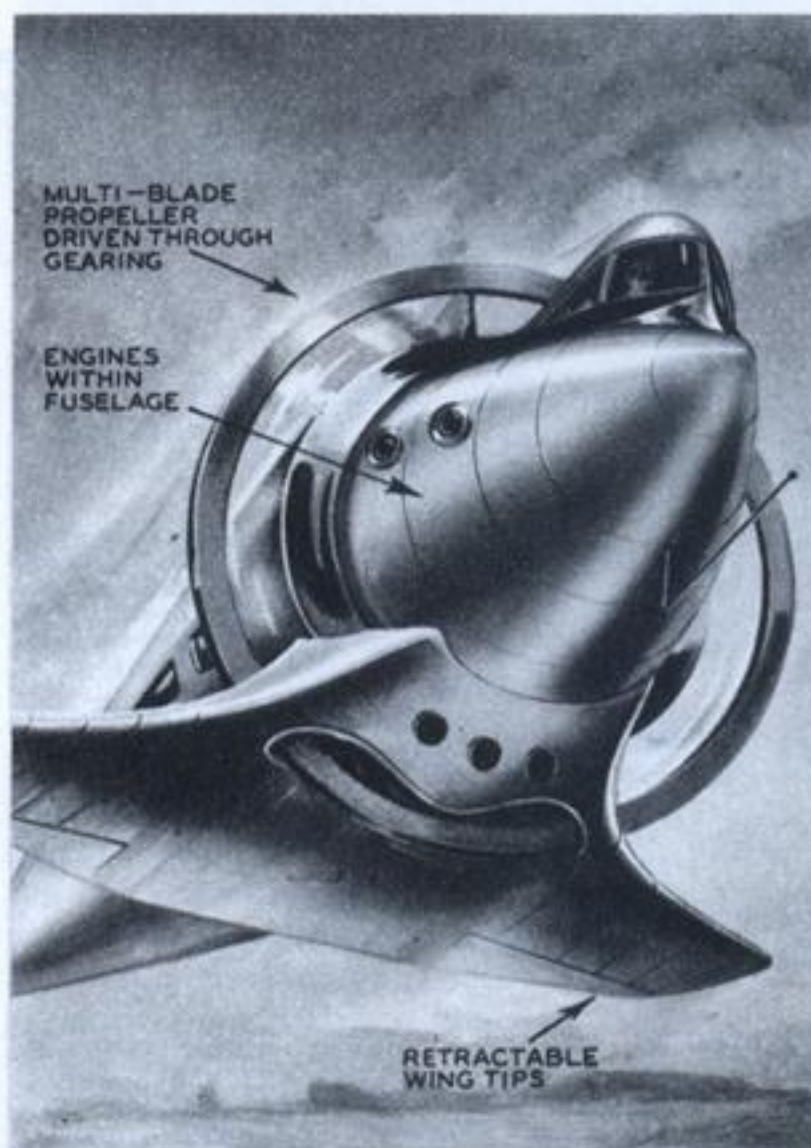
by DOUGLAS P. ROLFE

FIVE hours out of New York and the flasher lights of the Central London Air Terminal are blinking their welcome to the Trans-Oceanic express as it glides to a swift, effortless landing.

Five hours out of New York! This and similar pictures of future transportation have been painted ever since man first flew, but today it can be said that this is no idle fancy or paper prophecy. Even the most casual review of various activities in the United States, Great Britain and France show the vast number of experiments that are now being conducted towards this very end.

Whether the final success of trans-oceanic flying lies in the development of huge flying boats such as the *China Clipper*, or in some radically different type of boat is a question no truly progressive engineer would care to answer. This much they will say—that speeds of 500 miles an hour or more must be regarded as commonplace.

Fantastic and dangerous as such speeds

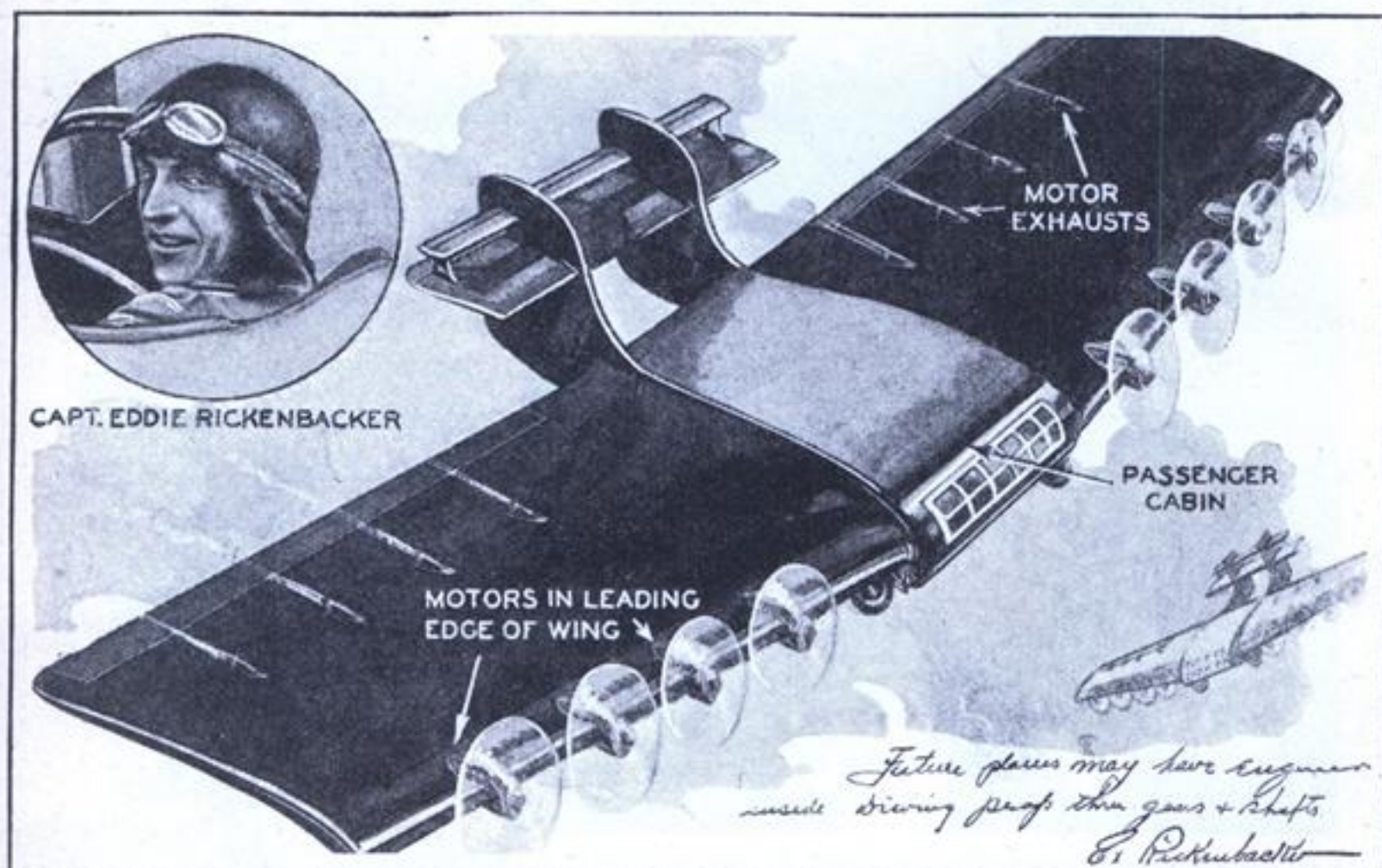


With wings reduced to a minimum this trans-oceanic plane is planned to span the Atlantic in five hours. In place of numerous motors blanketing over-sized wings, this craft uses a single power plant installed in the hull to drive a series of small, variable pitch blades constantly revolving about the circular ship.

appear to us now, it must be remembered that 20 miles an hour was regarded as being equally dangerous not so many years ago. The entire history of the motor car and airplane has been one of increasing speed. Again; the history of car and plane alike points to the fact that speeds developed in racing models are rapidly transferred and absorbed by the commercial patterns. So swift has commerce been to adapt the lines of speed planes that today in the United States there is the extraordinary situation of regular air liners being miles faster than the majority of the world's best military pursuit planes.

Racing planes are now assault-
[Continued on page 126]

Capt. Rickenbacker's



Captain Rickenbacker's conception of the flying wing of the future. Note his comment on sketch: "Future planes may have engines inside driving props thru gears and shafts."

By CAPT. EDDIE RICKENBACKER

America's war-time ace of aces who is now prominently connected with Fokker Aircraft tells of the remarkable ships of tomorrow now being built, and predicts revolutionary developments in flying.

SEVEN years ago with a pilot, mechanic and a traveling companion, I began an air tour of the United States.

It was a visionary journey in a cabin plane, with my companion, a young newspaper friend, making his first air tour. We rode in the cabin of the plane, carried our luggage in the baggage compartment and caused no little commotion as we began our trip from a landing field near New York City.

For the first day all was well. The second day our troubles began. The third day they multiplied. The fourth, they were magnified, and the fifth, they became disastrous when the ship was completely wrecked.

My companion and I completed the journey in a smaller, open war-type biplane, but it was rough travel in comparison to the impressive journey we had

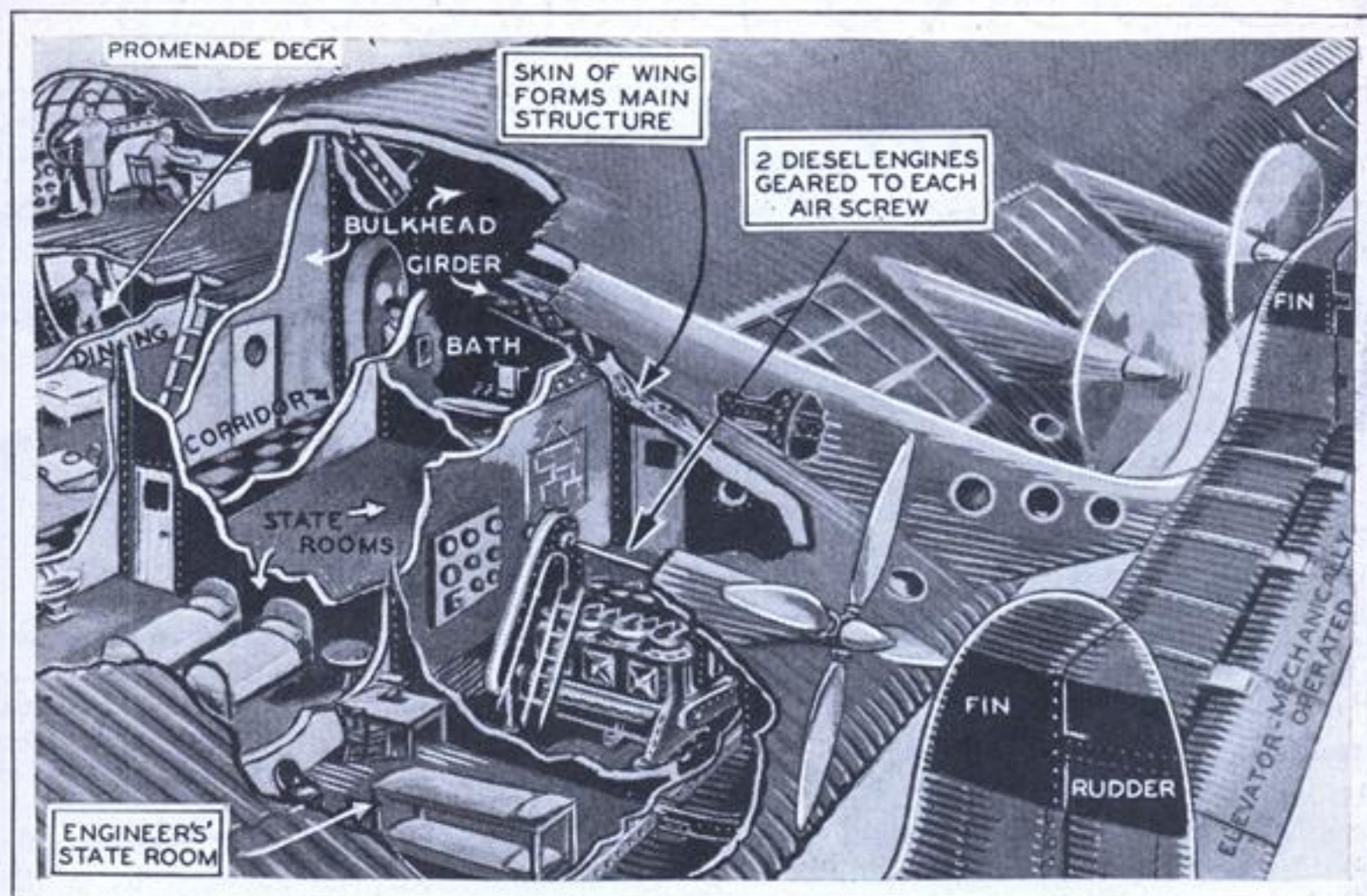
mapped out for ourselves in the cabin ship.

At that time in my utter disappointment I made the bland statement that there was not a single cabin ship capable of making the extensive tour we had planned. Air enthusiasts and members of the infant industry heaped verbal coals of hatred about my head. But it was true.

During that trip I made many appearances before luncheon clubs and banquet parties, discussing the future of aviation in an imaginative trend. There were many breath-taking statements in my more or less set address. It was necessary to shock audiences into semblance of the realities that were just ahead in the aviation world.

My youthful companion used to laugh after every appearance at which I gave my visionary views on aviation. "In one of these towns," he used to chide me, "they'll put

Giant Flying Wing With Rudimentary Fuselages to Carry Tail Group



An artist's conception of a section of the flying wing of tomorrow suggested by Captain Rickenbacker. Note that the plane shown is a giant wing with rudimentary fuselages to carry the tail group. These fuselages to house the crew. Motor rooms each housing two Diesel engines connected to pusher props. Main structure is the wing skin itself with longitudinal and transverse bulkheads. Bulkheads may also form internal walls.

time and very likely at rates that will be cheaper than rail transportation.

Amazing as it may be, I fancy I see in the future big wings flying through the air carrying fifty people. I feel certain that the design of tomorrow will be as different from today as the first automobiles were from the luxurious creations we see skimming along the road today. The designers seem to feel that the fuselage of the ship serves no purpose although all the ships have them today. But tomorrow we may see big wings, housing the motive power, as well as the passengers, who will ride in comfort in staterooms with all modern conveniences.

It is not at all unlikely that within a few years we will have big hotel terminals for the night riding air traveller. He will go in the evening from his dressing room in the terminal to his compartment on the plane for a 1000 to 1500 mile night ride clad in dressing robe or beach pajamas. His street clothes will be handed to a valet who will care for them on the trip and present them to him in his dressing room

in another air terminal at the end of the journey the following morning.

This type of travel, of course, is domestic. The mind cannot grasp the huge size of the transoceanic flying ships of the future. To say that they will carry more passengers than our present day floating cities is not ridiculous. The dirigible will some day find a happy combination with the airplane. Again, it certainly will be a question of pay-passenger load and the size of ship which can best be designed to fit the needs.

It must be recalled that there is more air than water. The ocean of air is the largest we have. There are no physical limits to the sizes of either airplanes or combination plane dirigibles of the future. There will be, however, economic boundaries, and it is within these that the ultimate ship will come.

No guess as to size, speed or use of airplanes is too radical to be considered, in my opinion. Many freaks will be built—but out of the maze of development will come the progressive ship of tomorrow.

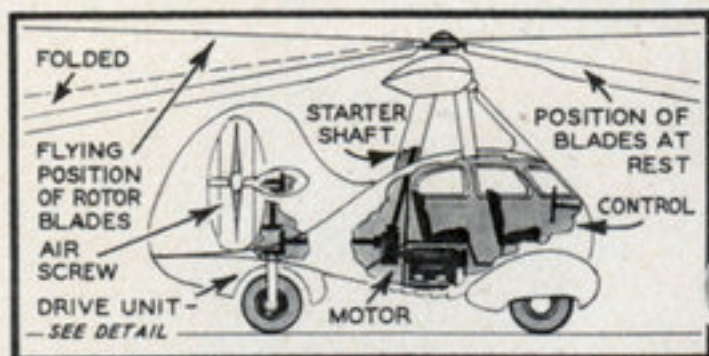
GIRO-Automobile FLIES Without WINGS

The wing-less autogiro and the invention of a combined land and air drive makes the dream of the flying auto come true.

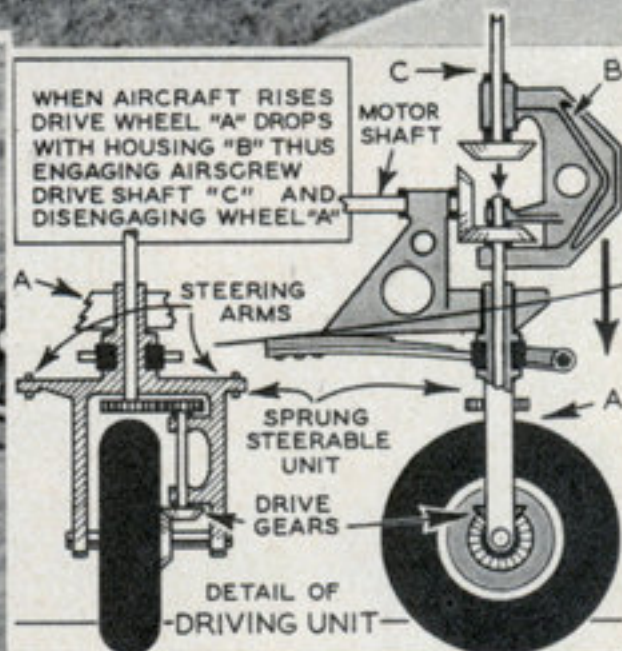
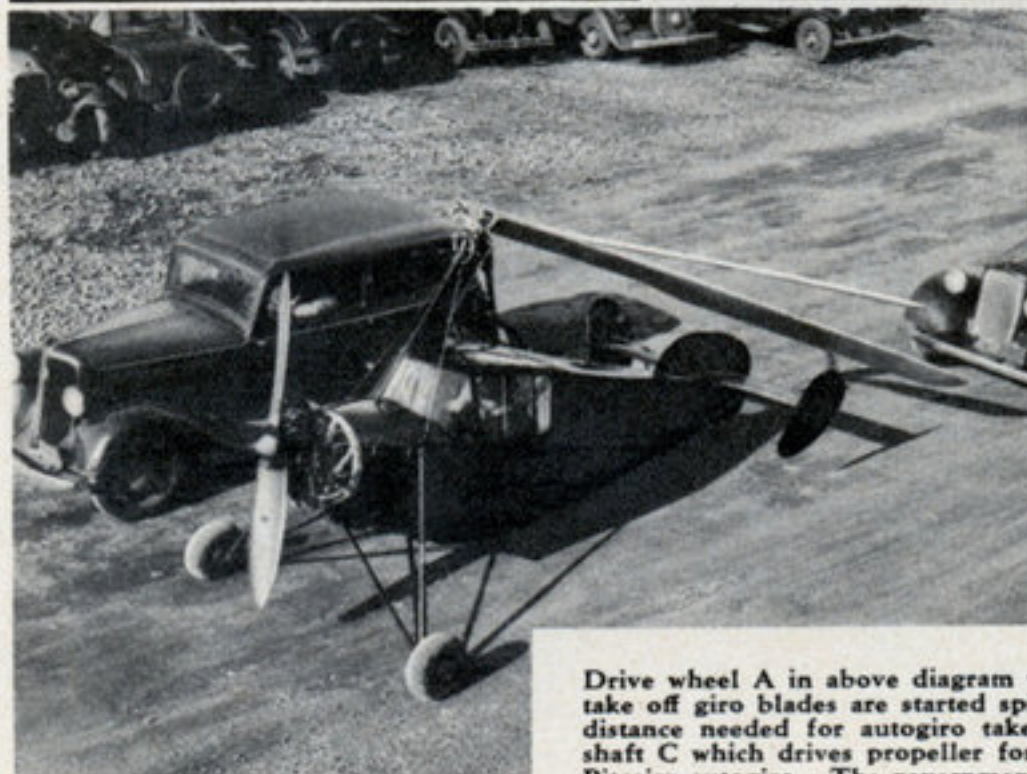
FLYING automobiles are within reach of the public today as a result of a dual drive for land or air invented by Edward A. Stalker, of Ann Arbor, Mich. His gear drive includes a simple clutch which engages a wheel to drive the car on land or a propeller to push the vehicle through the air.

Based on this invention, the giro-automobile was designed. In appearance it resembles the modern streamlined, rear engine automobile. No wings are necessary as autogiro blades would provide the necessary lift.

The U. S. Bureau of Air Commerce has ordered the Pitcairn Autogiro Company to design an autogiro airplane-automobile for amateur fliers, which with its rotor blades folded back and its engine geared to the wheels can be driven on a highway like a motor car.



Sectional diagram above shows how Stalker's dual drive system would be used in giro-auto.



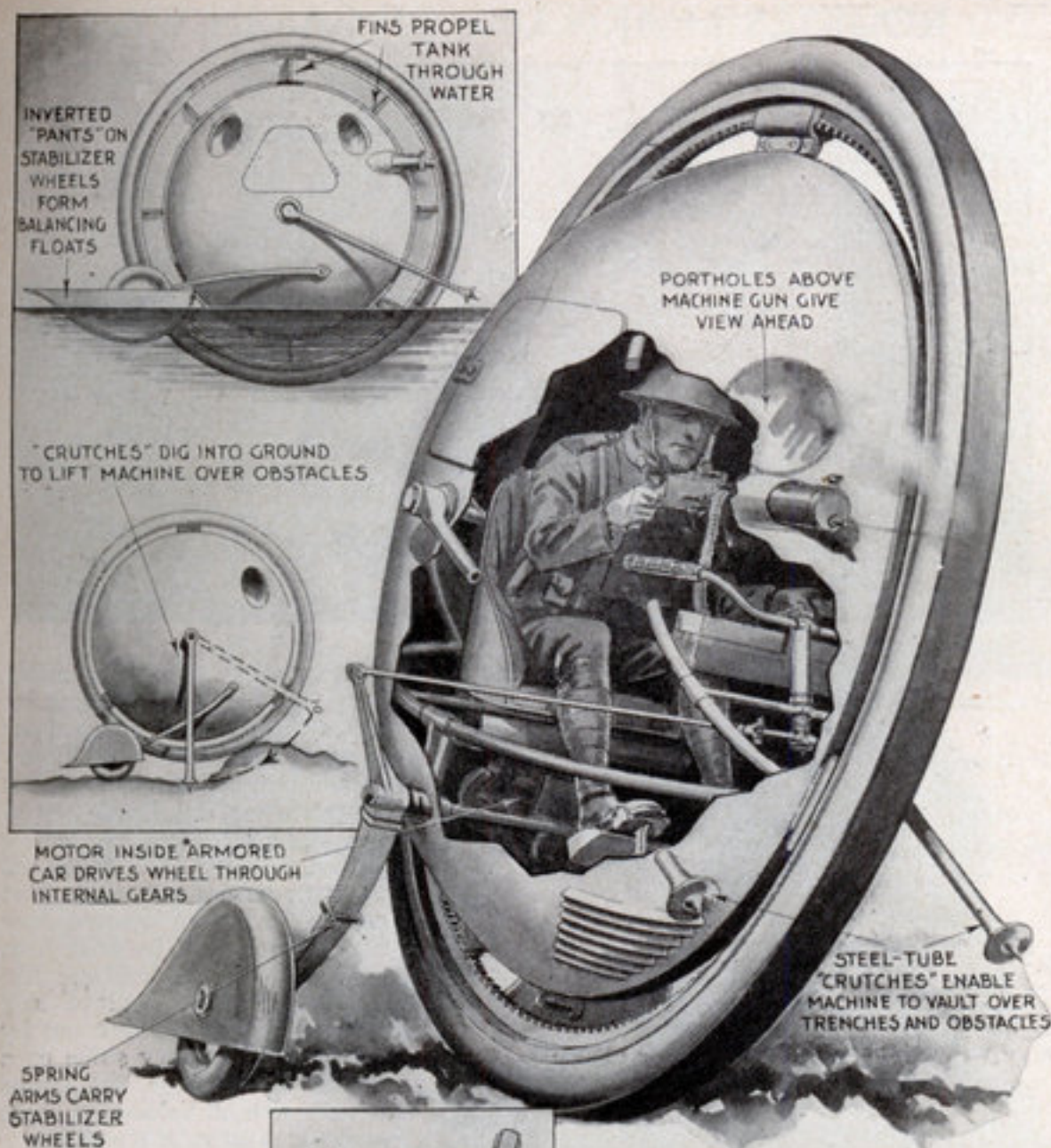
Drive wheel A in above diagram would propel flying automobile on land. To take off giro blades are started spinning and drive wheel runs the car for short distance needed for autogiro takeoff. In flight, wheel would drop, engaging shaft C which drives propeller for forward flight. Photos show latest wingless Pitcairn autogiro. The government has ordered similar ships with geared wheels.

War Tank

ON

One Wheel

OPERATED BY
ONE MAN



SUDDENLY, through the drifting smoke of a hard-fought battle, rush weird, one-man fighting tanks. They have the appearance of disk wheels and roll like hoops across the battlefield. Pouring out machine-gun fire, they leap over trenches, vaulting across on strange steel crutches to pursue the disorganized enemy.

Such is the startling vision foreseen by a New York inventor. He has just obtained a patent upon a unicycle-type tank which he believes will revolutionize battlefield tactics.

Housed inside the armored body, the operator will steer the single main wheel by means of two small auxiliary wheels at the rear. A turn of the handlebar lifts one stabilizing wheel and lowers the other, shifting the balance of the machine and turning it to one side or the other. An internal gear mechanism, operated by a motor inside the body, drives the wheel ahead at remarkable speed.

By a simple process of inverting the streamlined pants on the stabilizing wheels, so they form balancing floats, and attaching propelling fins to the main wheel, the tank can be turned into an amphibian

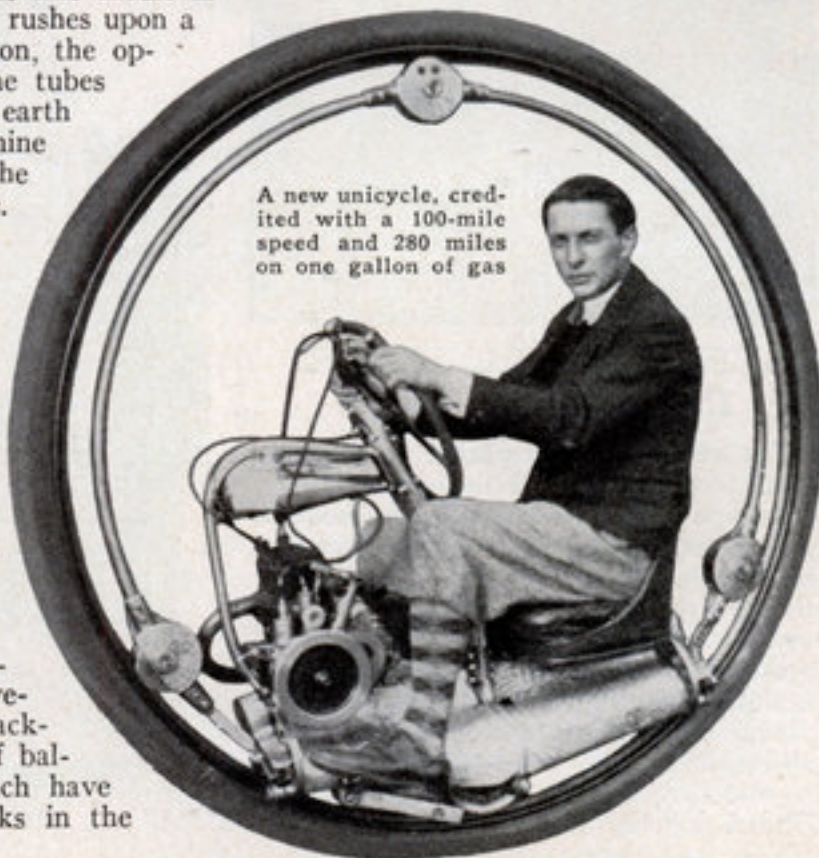
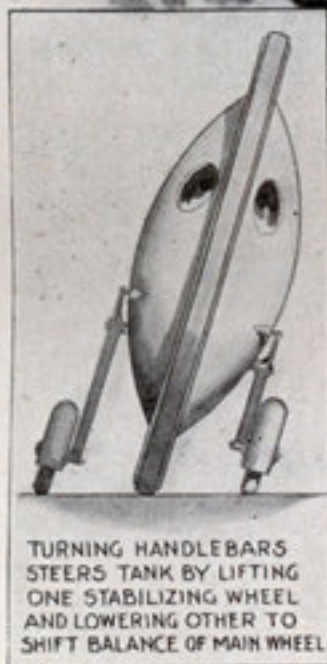
This one-man war tank, propelled by a hidden motor, would roll into action as is shown above. The diagrams also give a clear idea of how the machine runs on land or water

capable of plunging into a stream and rolling to the other side.

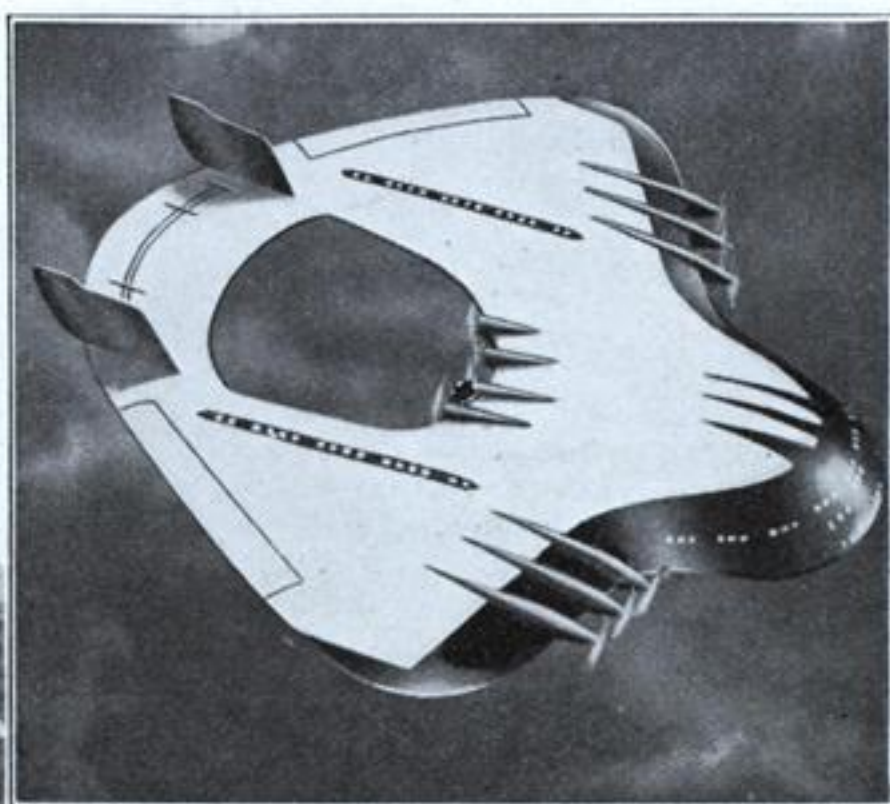
One of the oddest features of the revolutionary machine is formed by the steel-tube crutches that project ahead on either side like medieval lances. As the tank rushes upon a trench or obstruction, the operator will drop the tubes so they dig into the earth and the whole machine will vault through the air to the other side.

An open-type form of the vehicle, which is shown on our cover, has also been devised by the inventor. Without the armored body or the crutches, it is designed for highway use.

In various parts of the world, recently, engineers have been reviving the idea of the unicycle. Attracted by the economy and compactness of a one-wheeled vehicle, they have been attacking anew the problems of balance and propulsion which have been the stumbling blocks in the path of the inventors.



Flying WING Is AIR LINER of Future

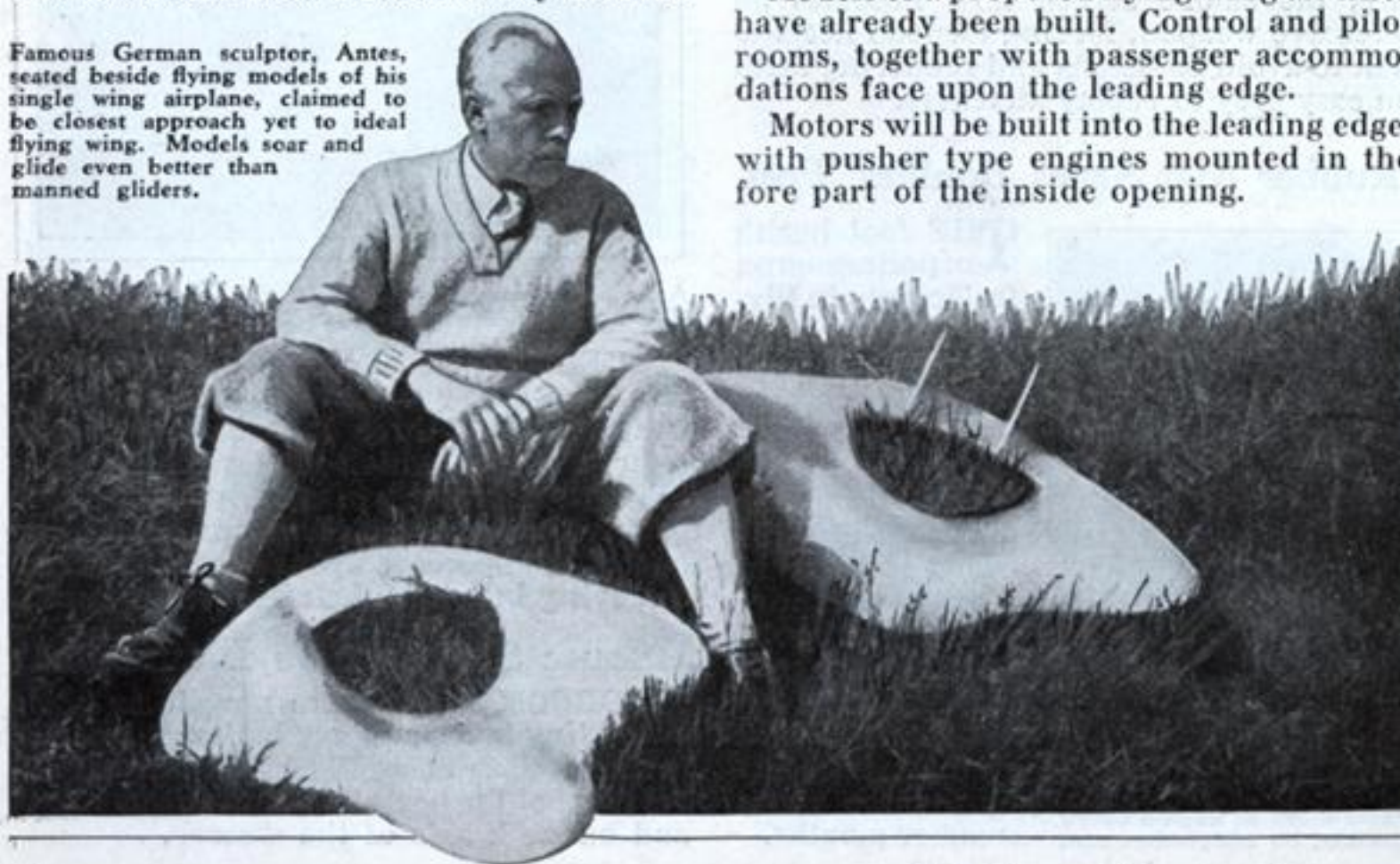


Left: Launching a model of the Antes single wing plane. Above: Proposed flying wing air liner, models of which have already been built. Note large opening in center of wing, with four pusher type engines mounted in fore part.

THE famous German sculptor Antes has developed a radically new type of airplane which promises to come closer to the ideal flying wing than any other type of aircraft.

The Antes plane has absolutely no fuselage or tail structure. The single wing structure is stream-lined in such a way that the

Famous German sculptor, Antes, seated beside flying models of his single wing airplane, claimed to be closest approach yet to ideal flying wing. Models soar and glide even better than manned gliders.



craft is stable under all flying conditions.

Perhaps the most unusual feature of this plane is the central wing opening. It is this opening which gives to the plane its unusual flying characteristics.

Flying models of the Antes Single-Wing have shown exceptional stability. Like a manned glider the pancake-like craft glides and soars over hill and dale, utilizing every upward air current.

Models of a proposed flying wing air liner have already been built. Control and pilot rooms, together with passenger accommodations face upon the leading edge.

Motors will be built into the leading edge, with pusher type engines mounted in the fore part of the inside opening.

The FLYING Automobile is Here



Artist's drawing shows the "flying auto" doing duty as both plane and auto. When it is to negotiate the highways the gyro blades are disengaged and power applied to wheels.

THE "flying auto," a combination airplane and automobile which negotiates roads and air lanes with equal facility, has at last appeared in the aeronautical world.

Designed by two German engineers, the craft is a development of the autogyro. A great advantage, however, is that no propeller for the drive in the direction of flight is necessary. The little vertical fins on the gyro blades give the necessary force to drive the car forward in the air.

When the craft is to be made ready for a trip along the highways the gyro blades are folded back as illustrated in the artist's drawing above. On the road the motor, which is located in the front as an accompanying photo shows, drives the wheels like a regular auto, the steering, however, being done by the rear wheel.

Streamlining principles are applied as in a plane, which makes for maximum speed.

The "flying auto" was exhibited at the Berlin airplane show. Some difficulty has been encountered in mounting the engine, so that it is not likely that the plane will soon come into popular use.



Photo above shows the new "flying auto" as it was displayed at the Berlin Airplane Exhibition recently. Motor is mounted in the front as in an auto, the power being transmitted from there to either the gyro blades or the front wheels. Note the headlights in the fenders over the wheels.



Forward propulsion of the plane is obtained through action of the little vertical fins on the gyro blades, eliminating customary prop.

Car Look Like?

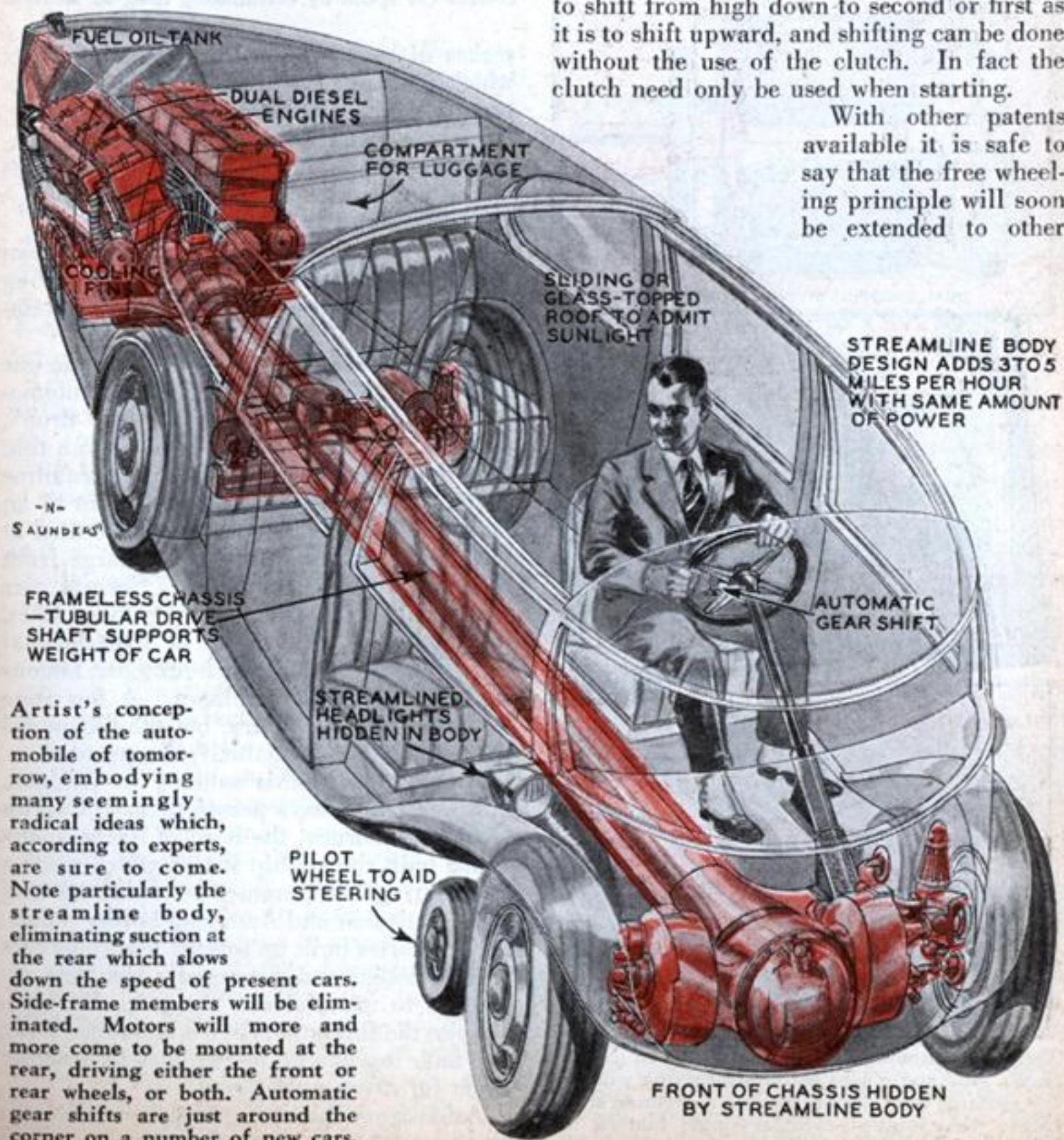
by JAY
EARLE MILLER

companies had been testing free wheeling devices last winter and in the early spring, with equipment designed under other patents than those used by Studebaker. Free wheeling, as Fred Duesenberg, the famous auto designer, explained in *MODERN MECHANICS* of last April, is to the automobile what the coaster brake was to the bicycle.

In the early days of the bicycle the engine—represented by the rider's legs—pushed the machine up the hills and continued to operate on the down grades. When the

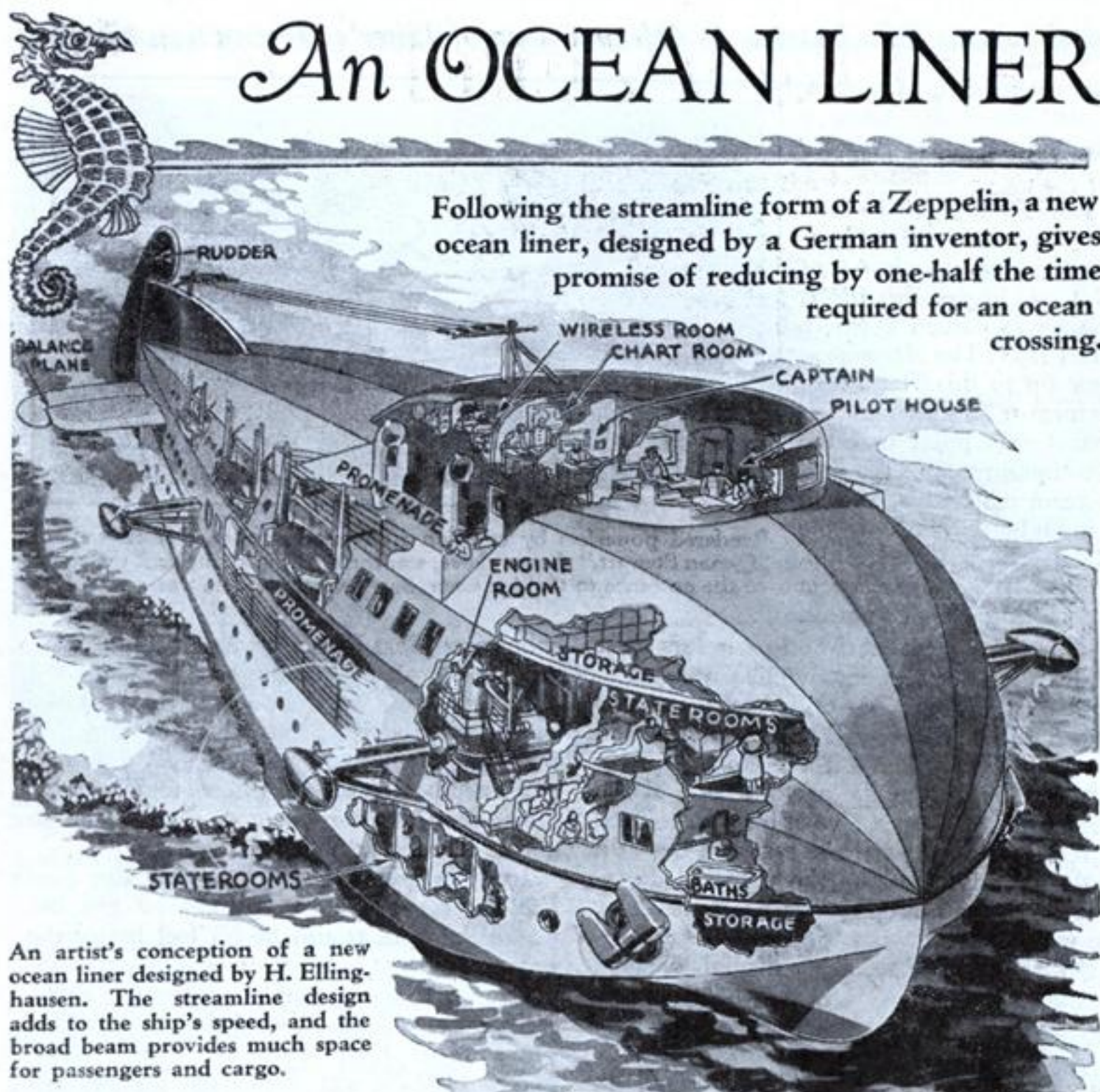
coaster brake came along the human engine pushed the load up grade, and then rested and saved its energy while coasting down. The free wheeling device, which is built into the transmission behind the gear box, does just that. As soon as car momentum exceeds engine speed the car coasts, instead of turning the engine over against compression, in the same way that the first bicycles turned the rider's legs. Naturally there is a saving in gasoline and a saving in wear and tear. And—not the least important—it is as easy to shift from high down to second or first as it is to shift upward, and shifting can be done without the use of the clutch. In fact the clutch need only be used when starting.

With other patents available it is safe to say that the free wheeling principle will soon be extended to other



Artist's conception of the automobile of tomorrow, embodying many seemingly radical ideas which, according to experts, are sure to come. Note particularly the streamline body, eliminating suction at the rear which slows down the speed of present cars. Side-frame members will be eliminated. Motors will more and more come to be mounted at the rear, driving either the front or rear wheels, or both. Automatic gear shifts are just around the corner on a number of new cars.

An OCEAN LINER



Following the streamline form of a Zeppelin, a new ocean liner, designed by a German inventor, gives promise of reducing by one-half the time required for an ocean crossing.

An artist's conception of a new ocean liner designed by H. Ellinghausen. The streamline design adds to the ship's speed, and the broad beam provides much space for passengers and cargo.

WILL the ocean liner of the future take advantage of the lessons learned by airship engineers and pattern its design after the streamlined *Graf Zeppelin*, *Los Angeles*, *R-100*, and other famous lighter-than-air craft? That such is the present tendency is indicated by the contemplated ship shown in the artist's drawing above, and depicted on this month's cover of *MODERN MECHANICS AND INVENTIONS*. It is the invention of H. Ellinghausen, of Bremen, Germany, who in experiments with this type of design has developed speeds well in excess of 60 miles an hour.

Advantages of such a ship are obvious. Streamline design adds to the speed without requiring increase in power. The broad, rounded design of the ship allows interior accommodations to be laid out to the best advantage, without the necessity for cramped

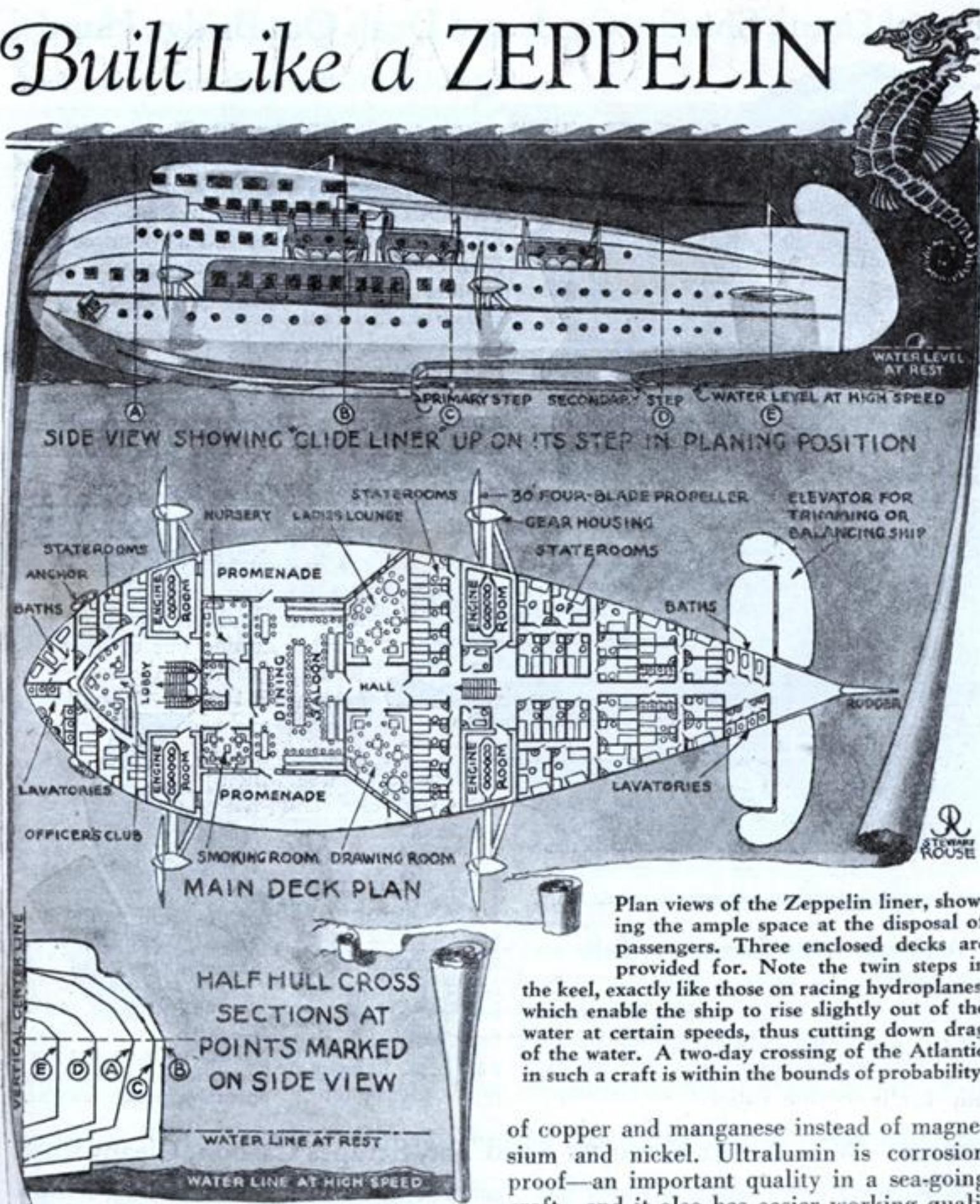


An experimental streamlined boat used by the inventor in working out the design for the liner.

staterooms as on the ordinary vessel. Placing the air drive propellers outside the hull enables the motors to be taken care of in a comparatively small space.

There is no danger of such a ship rolling over in a heavy sea, owing to the broad V-bottom. Placing steps in the bottom, following the practice of speedboat designers, adds

Built Like a ZEPPELIN



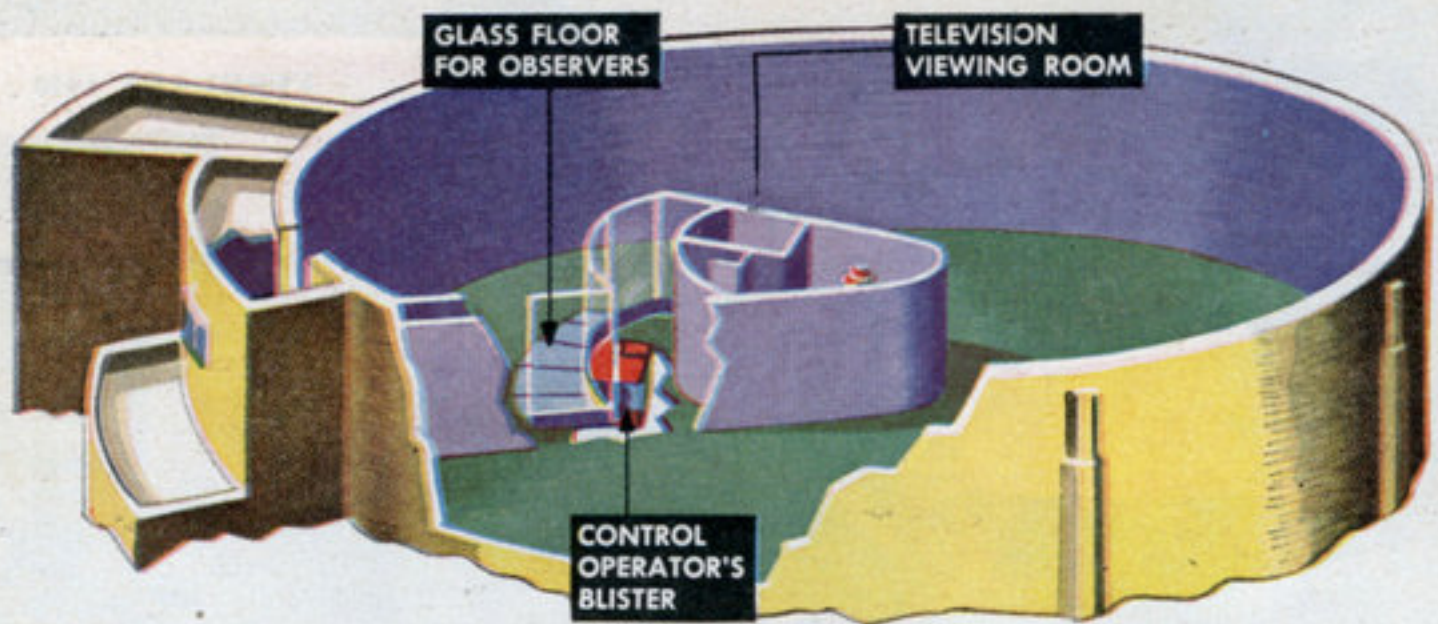
Plan views of the Zeppelin liner, showing the ample space at the disposal of passengers. Three enclosed decks are provided for. Note the twin steps in the keel, exactly like those on racing hydroplanes, which enable the ship to rise slightly out of the water at certain speeds, thus cutting down drag of the water. A two-day crossing of the Atlantic in such a craft is within the bounds of probability.

of copper and manganese instead of magnesium and nickel. Ultralumin is corrosion proof—an important quality in a sea-going craft—and it also has easier working qualities.

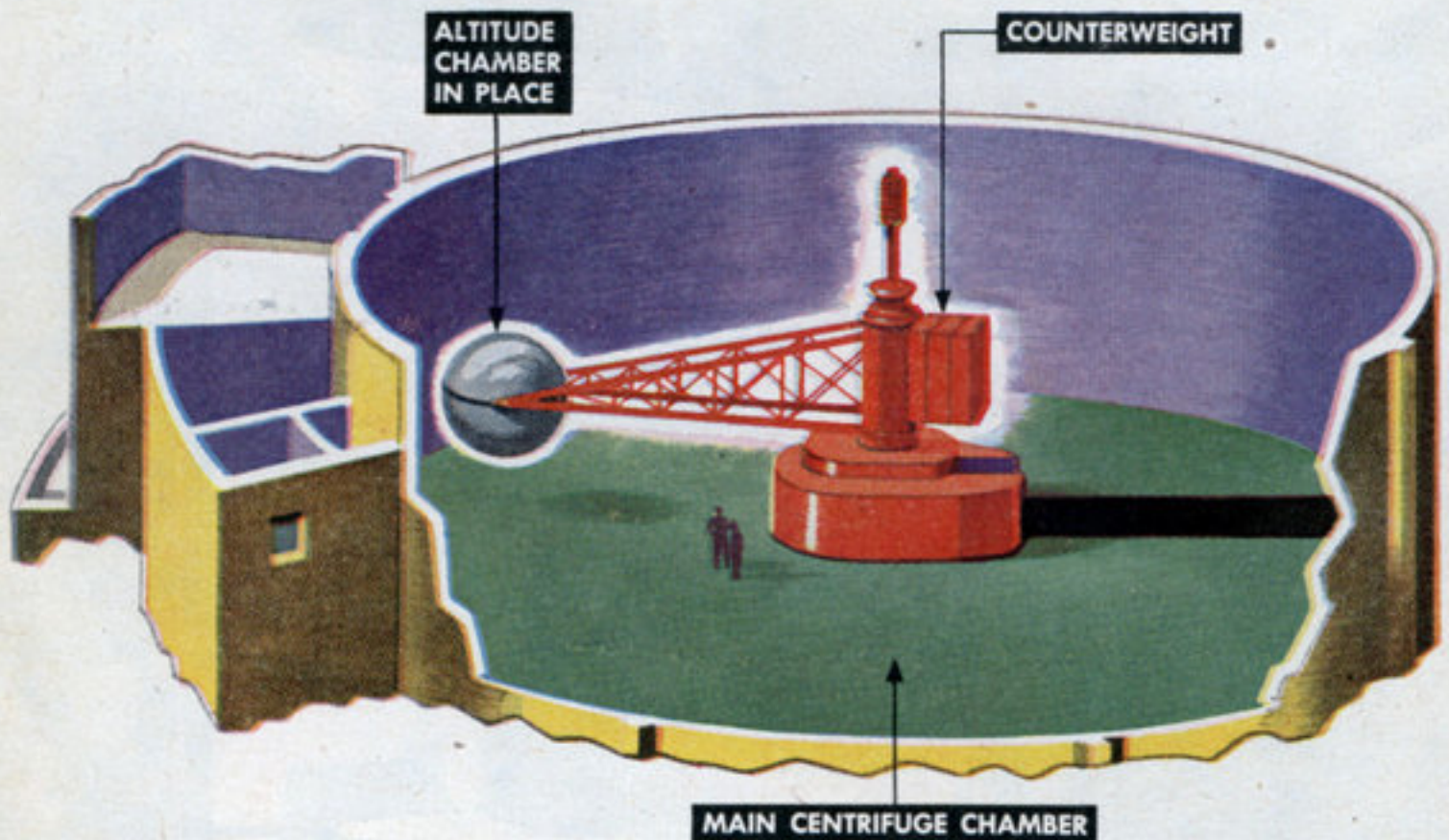
The record for an Atlantic crossing is now held by the German liner *Bremen*. It is notable that the *Bremen* is the first liner whose above-water parts have been consistently streamlined. Smokestacks, masts, and other exposed objects are streamlined to such good effect that it was almost inevitable she should capture the Atlantic speed record. Speed gained by streamlining is, as the saying goes, pure velvet. Adding more power to an existing design is an old way of increasing speed—at a considerable expense for fuel.

to the speed of the craft. Promenade decks are built into the side of the ship so that the wind created by the boat's own speed will not annoy the passengers. Tail controls similar to those on an airplane are used to keep the ship on its course, but an under-water rudder can also be added to get quicker response in emergencies.

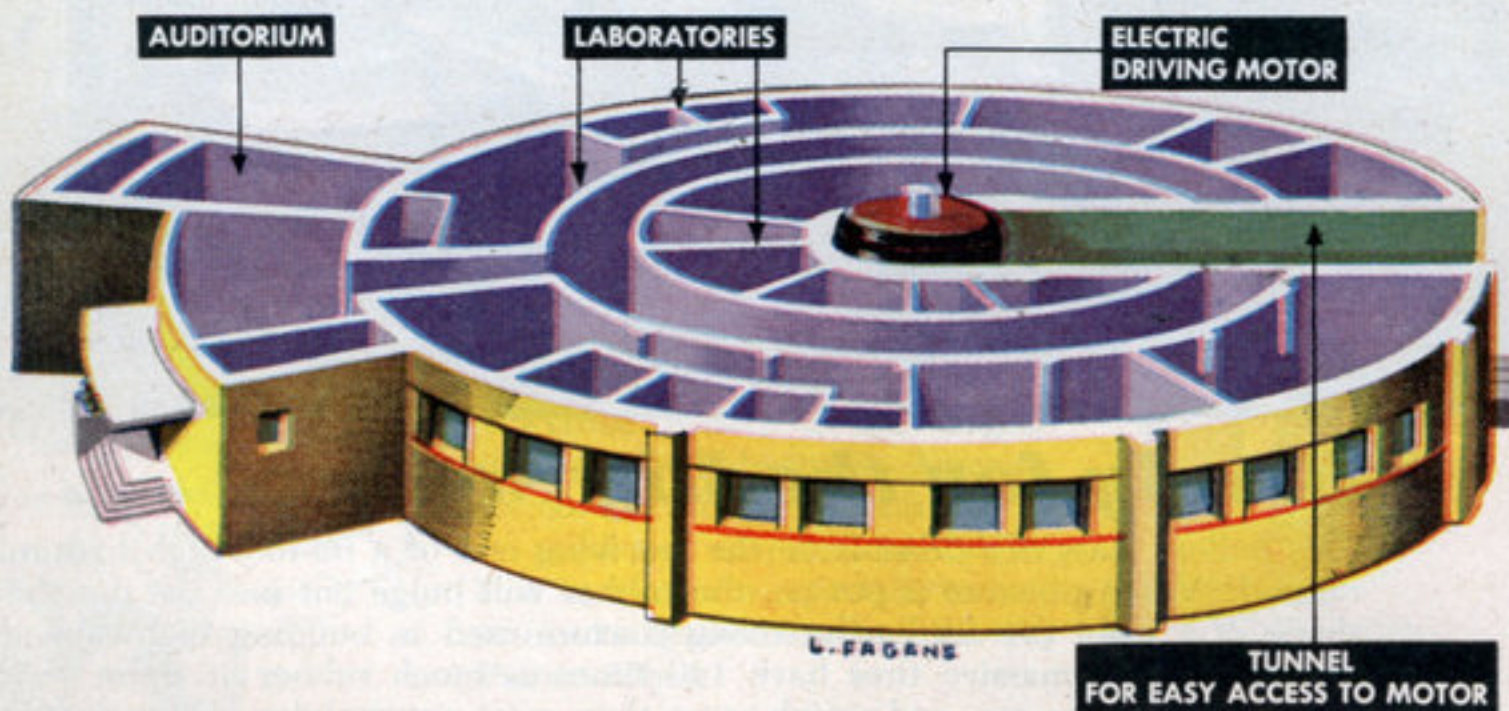
A special light metal which is the invention of Mr. Ellinghausen will be used when the ship gets under construction. He calls this metal ultralumin, and it differs from the more familiar duralumin in that it is an alloy



Observation facilities, television receiver, instruments, and control room are on top floor.



In main chamber is centrifuge with 50-ft. steel arm rotated by 145-ton, 4,000-hp. motor.



Lower floor houses laboratories that will analyze, help solve problems of supersonic flight.

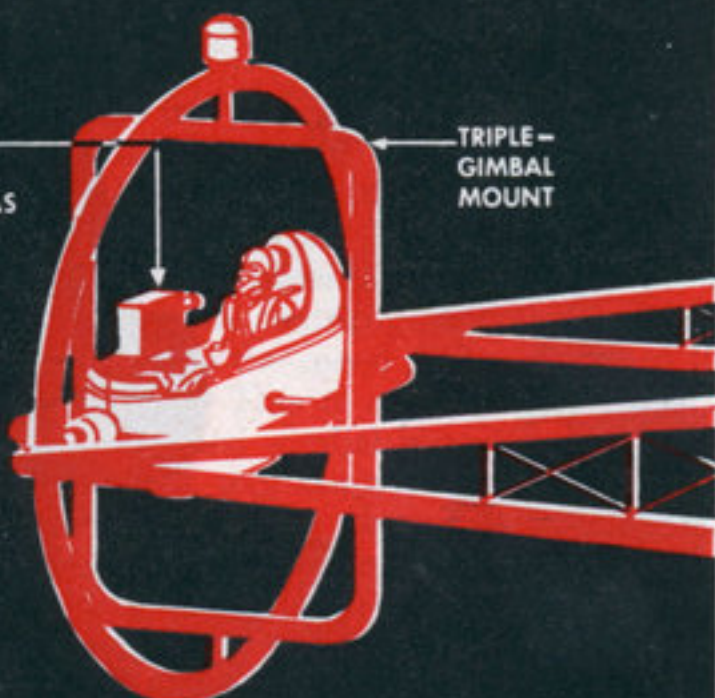
TELEVISION
SCREEN



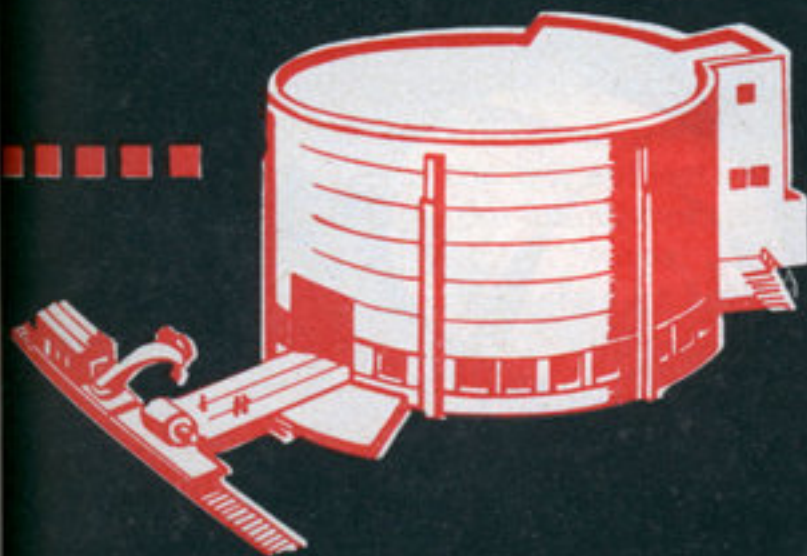
On the television screen, the doctor in charge gets a continuous view of the subject during a test.

TELEVISION
AND
X-RAY CAMERAS

TRIPLE-
GIMBAL
MOUNT



A motor-driven, triple-gimbal mounting allows the cockpit to be adjusted to any desired position.



The huge centrifuge building. A tunnel facilitates the removal of the motor for necessary repairs.

New Guns for Human Bullets

By George H. Waltz, Jr.

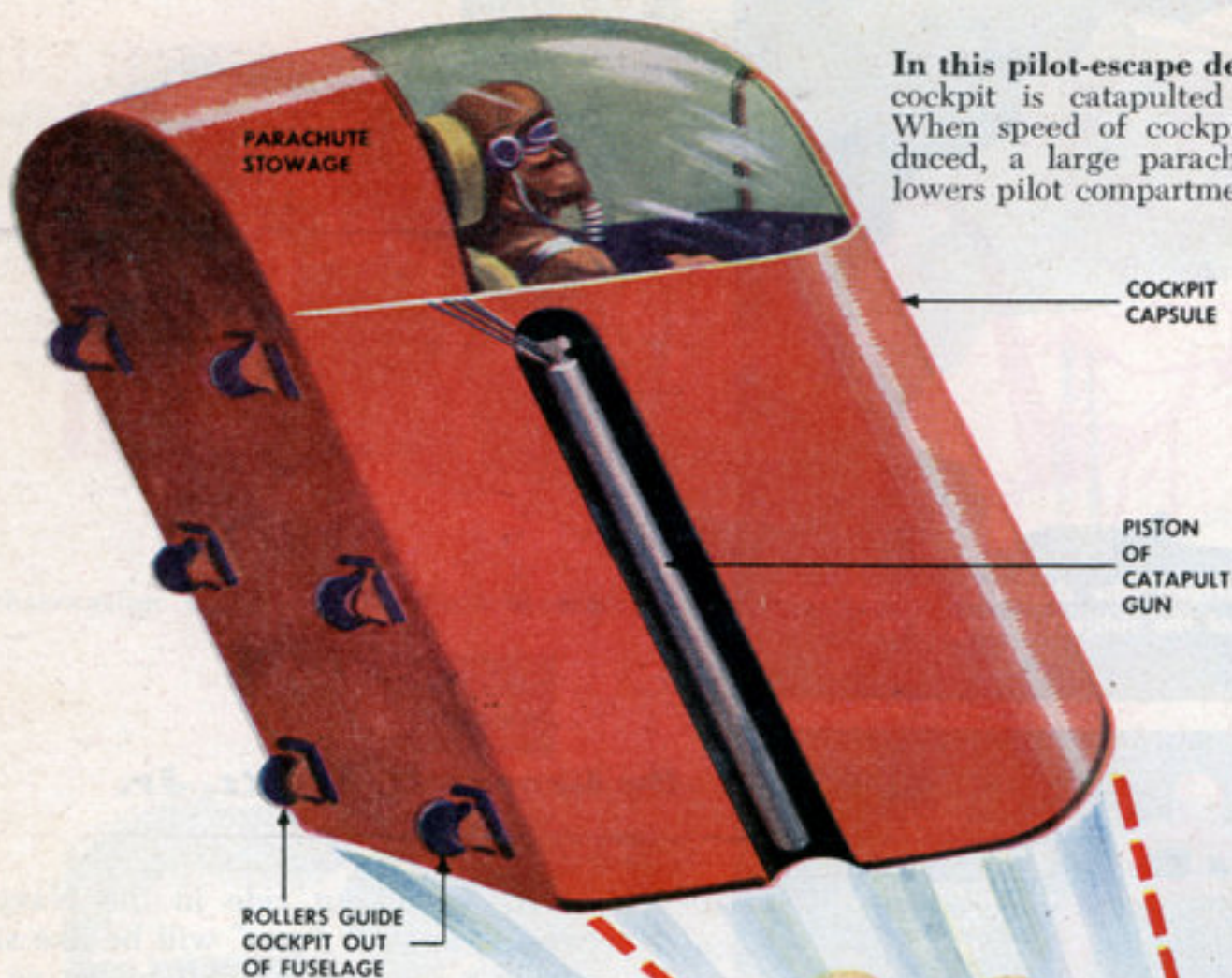
Drawings by Lester Fagans

TAKING an all-out ride in the Navy's newest laboratory "gun" will be like sitting astride a standard aircraft rocket as it starts toward its target. This "gun" is a human centrifuge to end all centrifuges—a giant, high-speed merry-go-round capable of making a man feel like a bullet being shot from a rifle.

Scientists will use the machine to learn a good many new facts about the physiological and psychological effects of high speeds and sudden changes in speed. They will do it by subjecting pilots to tremendous forces of acceleration and deceleration. As pilots and airplane manufacturers strive to bore deeper and deeper into the "no man's land" of supersonic and super-supersonic flight, new problems are arising. It is not now so much a question of whether the plane will hold together as: "Will the pilot?"

What happens inside the human body when it is suddenly accelerated or decelerated? What happens if, while shooting through the air at 1,000 m.p.h., the direction is quickly changed as in a pull-out from a dive or in a sharp turn? What effects does high altitude, with its reduced oxygen, have on a pilot's ability to withstand those forces? How will airplane instruments and equipment stand up?

It is to help dig out the answers to those questions and many other supersonic puzzlers that the Special Devices Center of the Office of Naval Research is building this \$2,500,000 centrifuge—the world's biggest and best equipped. It will be large enough



In this pilot-escape device, the entire cockpit is catapulted out of plane. When speed of cockpit has been reduced, a large parachute opens and lowers pilot compartment to the earth.

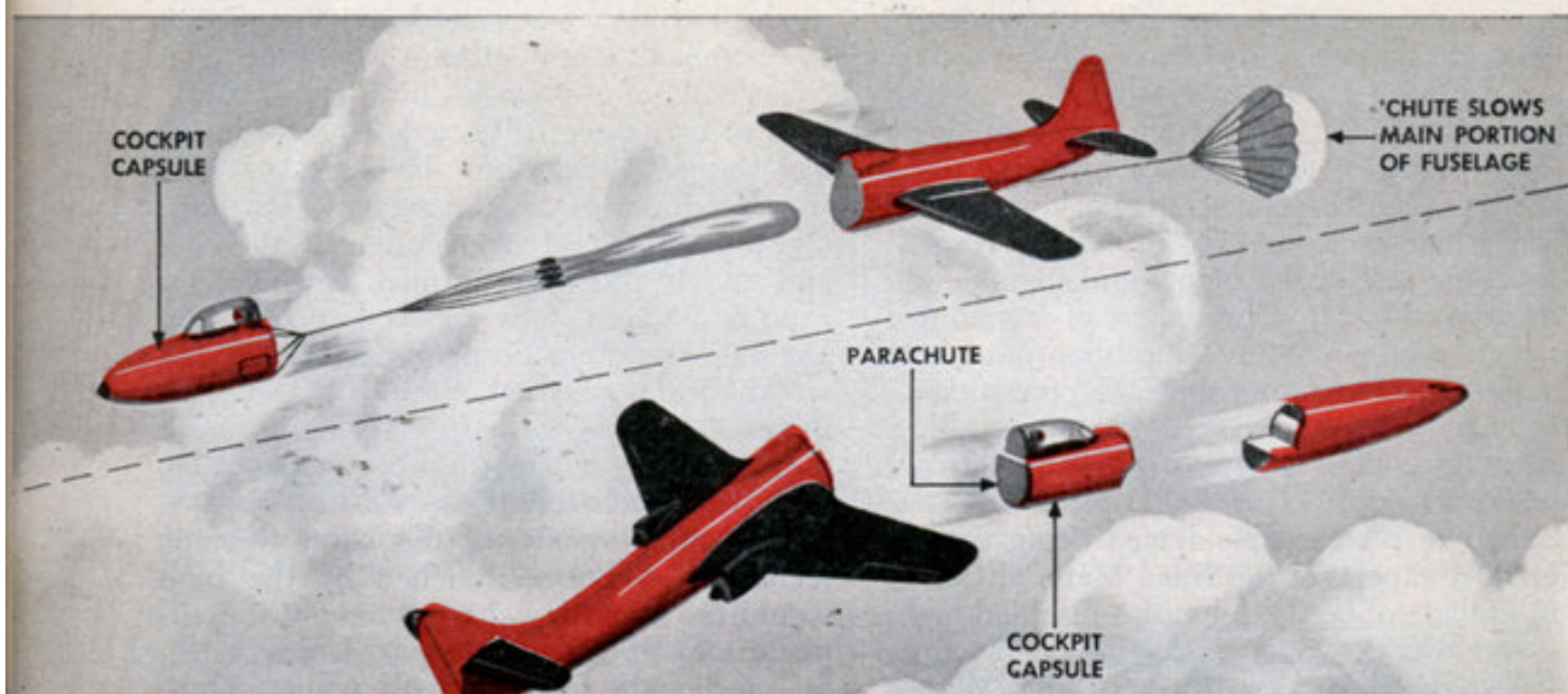
and spin fast enough to subject anything placed in its test cockpit to acceleration rates as high as 10 G a second (the normal force of gravity is 1 G, or the normal weight of a person or object). It will be possible to develop accelerations as high as 40 G, just about twice the maximum G force developed by any existing centrifuge. Such high G shots are not contemplated, however, for tests on human beings.

Housed in a smoothly modern, 130-foot-diameter, circular building near Johnsville, Pa., the new G-gun will have a 50-foot steel arm whirled by a 145-ton, 4,000-hp. electric motor. Mounted at the outer end in multiple gimbals like the flywheel of a toy gyroscope, will be the test cockpit or gondola.

A decompression chamber, a hollow sphere that clamps over the entire gimbal mounting with its cockpit, has been designed. With the chamber in place, air will be pumped out until the test subject is not only exposed to the G-forces of acceleration and deceleration, but to altitude conditions as high as 60,000 feet.

The two-way gimbal system (a last-minute engineering change from the original triple-gimbal design illustrated on p. 99) is one of the most important features of the new centrifuge. Electric motors at the axes of the gimbal mountings will automatically





Two versions of Navy's design for come-apart plane that enables pilot to escape at high speeds.

keep the test cockpit in such a position as to eliminate most of the unwanted effects of acceleration, regardless of the speed of rotation.

Seated in his observation blister hung from the ceiling, the centrifuge operator will have full control of the speed and gyrations of the test cockpit. This is made possible by the motor-operated gimbal mounting. An electronic brain will control the speed of the main motor and its giant arm with hairline accuracy. All the operator will have to do is set the controls for the accelerations he desires prior to a test run, and the electronic circuit will take care of the rest. So quick and smooth will be the action of the drive motor that the test cockpit can be shot from a standstill to its top speed of 174 m.p.h., (40 Gs) in less than seven seconds!

Television Tells Story

Observers will be able to watch the man being tested at all times through the eye of a television camera mounted in the cockpit. Automatic recordings also will be made of such things as the test subject's blood pressure, his pulse, the amount of oxygen in his blood, and his brain waves. Although the current design does not include the high-speed X-ray motion picture camera indicated in the artist's drawing on p. 99, provision has been made for its future installation; this would give observers a running record of what happens to the man's insides.

The building housing the centrifuge will be a complete aeromedical experimental station. On the main floor, directly under the

centrifuge, will be a darkroom, a surgery, and physiological, clinical, and biochemical laboratories. From these laboratories may come the answers that will help beat the problems of supersonic flight.

Getting the Pilot Out

One of the problems plaguing aeromedical experts as well as supersonic plane designers, is that of getting the pilot safely out of one of these high-speed craft should it develop trouble at high altitudes. Here it is a matter of violent G forces in the form of quick deceleration. The pilot must be safely slowed down from the speed of sound to a speed that permits a safe parachute opening and descent.

Until not so long ago, a pilot with a disabled airplane on his hands simply pulled back his cockpit canopy, bailed out over the side, counted 10 to get himself safely clear of the plane, and pulled the rip cord. But when plane speeds increased materially during the war, a powder charge was provided to blow the canopy free and make the pilot's escape easier. Next, with even greater speeds, came the Navy's record-breaking, jet-propelled *Skystreak* with its detachable nose (PS., Mar. '47, p. 93) and the ejectable seat that catapults both seat and pilot out of the cockpit.

In planes flying in the transonic speed zone at high altitudes, however, neither the jettisonable nose nor the ejectable seat would be completely effective. Without some overall protection against both the sudden brick-wall impact of a 700- to 800-m.p.h. slip-

Plywood Helicopter



Ever ride in a flying Easter egg?



Shock of power-off, emergency landing can be sustained by retractable, tricycle landing gear.

Photos by Ross-Pix

THERE'S an Easter egg in the sky! But it's the "Flying Easter Egg"—a new single-place helicopter called by that name because of the oval shape of its plywood fuselage. (See cover.)

Designed by Fred Landgraf, the H-2 can make 100 mph on its 85 hp Pobjoy engine. The center of gravity of the 850-pound craft lies *ahead* of the rotor axis, insuring greater stability.

Landgraf has stressed simplicity in his controls in order to appeal to a wider public—only stick and throttle action are necessary for flight. •



Inventor-designer Landgraf, below, checks the "spoilers" and ailerons on the tips of the rotor blades. They provide directional control. The automatic pitch control, left, allows the pilot to concern himself only with maneuvering the stick, the throttle and the foot pedal.



Sun-Melted SAND for AUTO ROADS



ONE of the most astonishing ideas ever advanced to the American public comes from Will W. Beach, of Los Angeles, California, who, as holder of patents on a sectional method of constructing 30-foot lenses, proposes that these immense burning glasses be used to harness the sun's rays for converting ocean water into steam (leaving pure water and salvaging salt, iodine, flour gold, etc.), for fusing sand into an impervious lining of canals dug through deserts to bring sea water for irrigation, and for melting sand which can be rolled out into a perfectly smooth surface for auto highways.

Various interesting applications of Mr. Beach's ideas are presented by the artist on this page. One which the inventor regards as most timely is that of supplying sparkling clear water for the city of Los Angeles by distilling it from the nearby ocean. This he regards as much less costly than the aqueduct which will carry water from Hoover Dam, more than 200 miles away, when that great engineering project is completed.



Above is the artist's version of proposed method of building canals lined with fused sand.



Roads of glass-like smoothness could be produced cheaply and swiftly if the Beach sun-lens operates as its inventor claims. A projected method of road construction is illustrated above. A cylindrical lens the width of the road concentrates sun heat on the sand beneath, melting it. While still in a viscous condition, a roller passes over it and smooths it into shape. Such a road would be practically immune to the ordinary wear and tear of traffic. A tread on the roller would make the road skid proof.



Harvey Earl, GM's style chief, poses with his rear-engine Corsair.

General Motors' Rear-Engine Car

WHENEVER the subject of rear-engine cars plays across the auto columns of the nation's newspapers, a certain bunch of boys in Detroit snicker to themselves!

Rear-engine cars! Not for the American public, they say. And they ought to know. They're the head stylists and engineers for General Motors Corporation. Why are they so convinced?

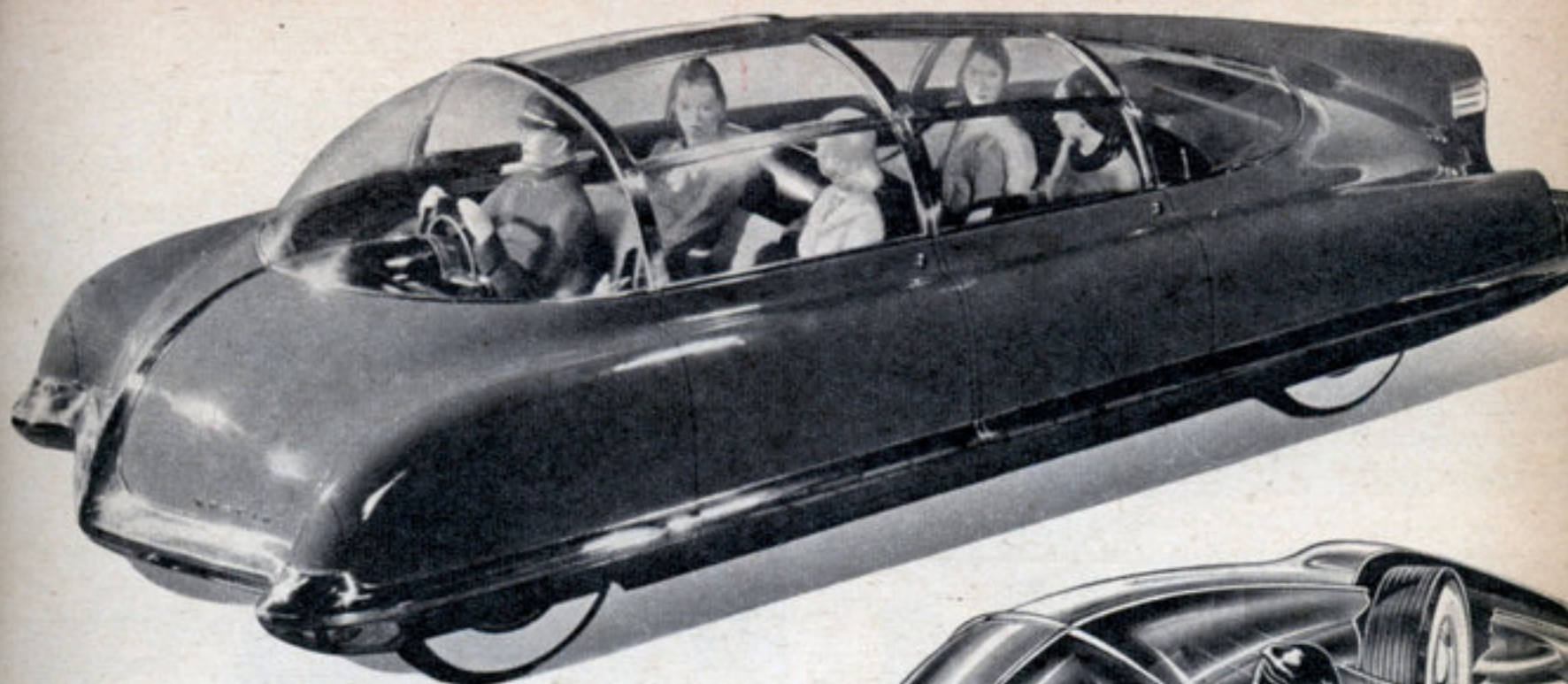
They know this rear-engine stuff isn't new at all. In 1902, 18 out of the 23 automobiles in production had their engines placed aft. But then gradually the engineers were overcome with violent symptoms of *front-engine fever*. They wanted to put the motors up front! And they said they had good reasons for doing so.

Safety was one of these reasons and better weight distribution another. They got their way eventually and soon almost all

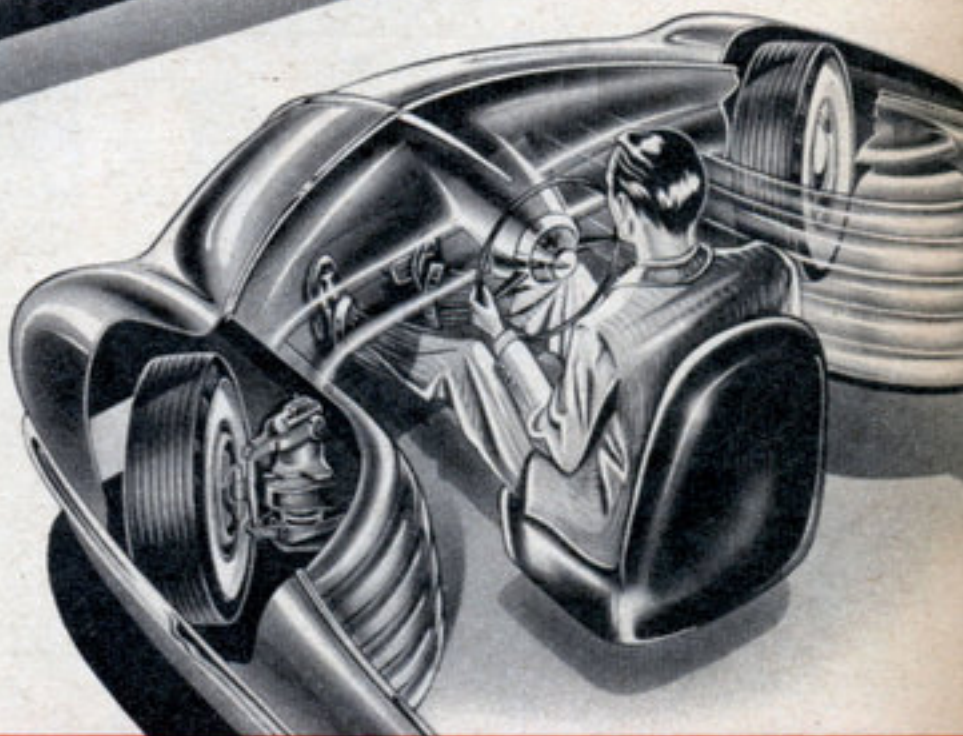
By Bernard W. Crandell

American cars were being manufactured with engines in the front. But then the picture started to reverse itself. In 1925, the Julian chugged into print with "the first rear-engine car in 20 years." Entirely unsatisfactory and "old-fashioned," it shortly thereafter became the first rear-engine model to go off the market in 20 years, too.

In 1931, Sir Dennistoun Burney, noted airship designer, had a go at a rear-engine car. He tried to peddle it to GM and Studebaker on the theory that its 66-33 weight distribution (66% of the weight on the back wheels and 33% on the front) would, when the breaks were applied, shift to a 50-50 balance. He also thought his machine took the bumps easier with front-wheel shocks rotating in an arc from the rear axle, and bumps under the back wheels being absorbed by a rotation around the front axle.



The sleek Corsair, shown above and on MI's cover, was built to test the merits of moving the modern auto's motor from the front to the spot usually occupied by the baggage compartment. The cutaway drawing at the right shows the big drawback in this revolutionary design—the narrow seat up front. Turning space for the wheels allows room for only driver.



MI reveals the exclusive story behind the mysterious stern-powered GM auto—and tells why you can't buy one today.

If this sounds screwy, it's typical of some of the inspired double-talk that has been going on ever since the revival of the rear-engine ruckus.

The Burney design, which went wholehog on radiators with one in back to cool the engine and another in front to heat passengers, was sold eventually to the British Crosley. They came out with a \$3000 sedan which set no sales records.

An experimental rear-engine design made its appearance in 1933. John Tjaarda, a Detroit who designed two experimental models for the Briggs Manufacturing Company, claimed it was ridiculously simple to drive. He explained in the magazine *Automobile Topics*: "When starting, all one has to do is turn on the ignition, when a red light will show on the dash. Then step on the throttle which simultaneously starts the engine and the red light will go out and

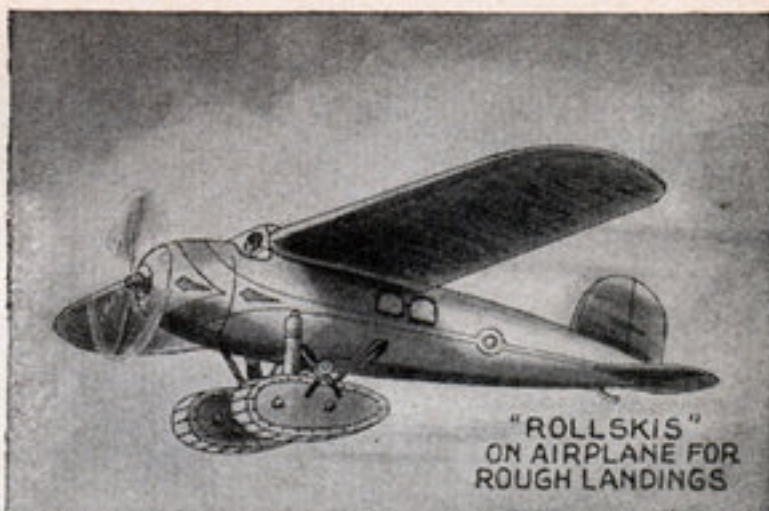
a green light shows. As the engine can not be heard in the front seat, the lights will tell what is happening in the rear."

Tjaarda's cars caused a mild sensation in the industry for a year or two. Then Chrysler and Ford, potential customers for whom Briggs already made bodies, had to decide whether the sensation was good or bad. The freaks had V-8 engines mounted over the rear axles and buzzed through the streets of Detroit without mishap until winter arrived. The original notion was that the engine heat could not seep forward and cause discomfort during hot weather. As it turned out, passengers were cool enough in summer, but during the winter they froze. No heating system had been devised!

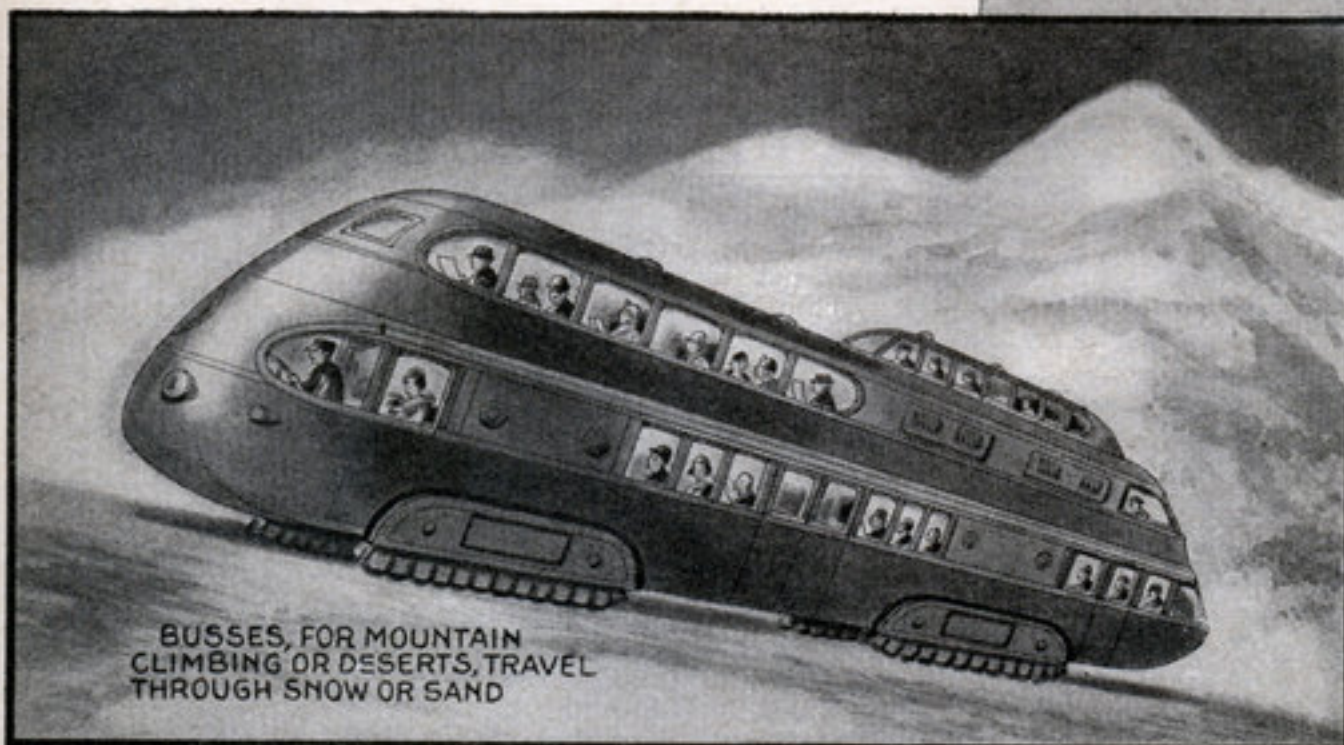
Most unconventional and probably most comfortable of all interiors in a rear-engine experiment was brought out several years before World War II by William B. (Bill)

Rubber-Footed Vehicles

For Land, Water and Air, to Make Exploring Safer and Easier, and Develop Rugged Country.



The rubber landing surfaces will, it is claimed, prevent crackups by keeping the plane in steady motion till it stops.



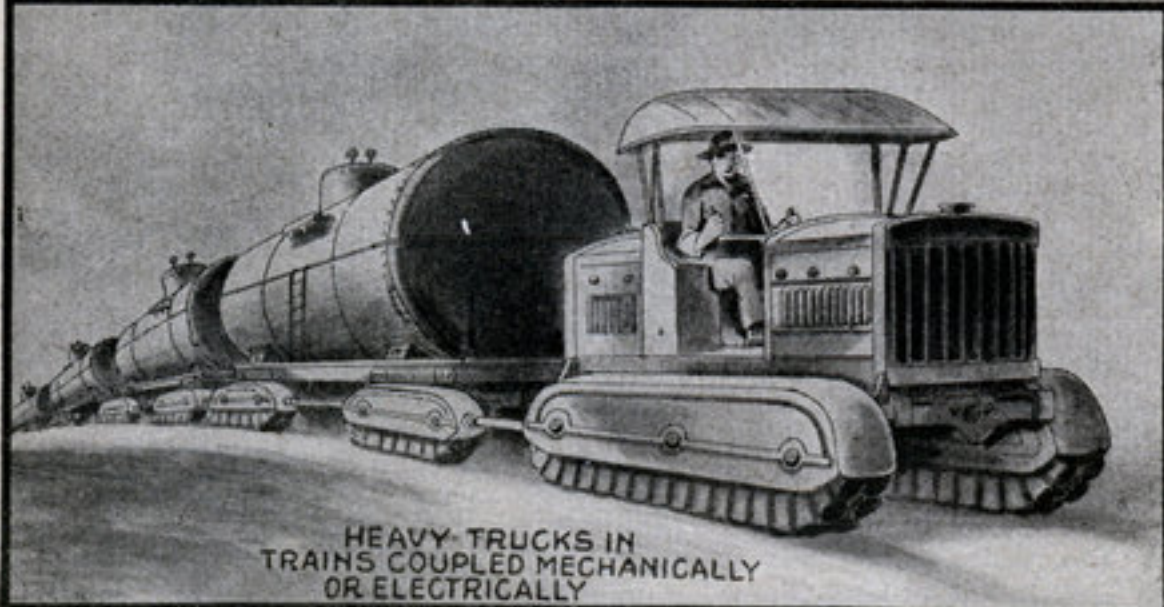
rear caterpillar drive.

Yet the caterpillar, at a high speed, would be quite destructive to any ordinary road, with its iron pedals; and a new device, as here illustrated, is now in use (in Switzerland) to combine the best features of both methods. The moving belt of the caterpillar is armed with solid rubber cushions which grip the ground firmly, distribute the pressure, and eliminate the shock and noise (which soldiers might disregard, in a tank, but not ordinary passengers).

Cars of this type have been used to climb Mont Blanc, the St. Gothard, and other lofty mountains, and it is stated that wider commercial distribution is to be undertaken.

It is also suggested that such a car as that illustrated below, capable of going over land and through water, would be useful in exploring new countries, where roads are lacking. The design, outlined by the German engineers, B. and H. von Roemer, in *Das Buch für Alle*, is strangely reminiscent of certain stories of invention which were familiar to American youth in the last decade

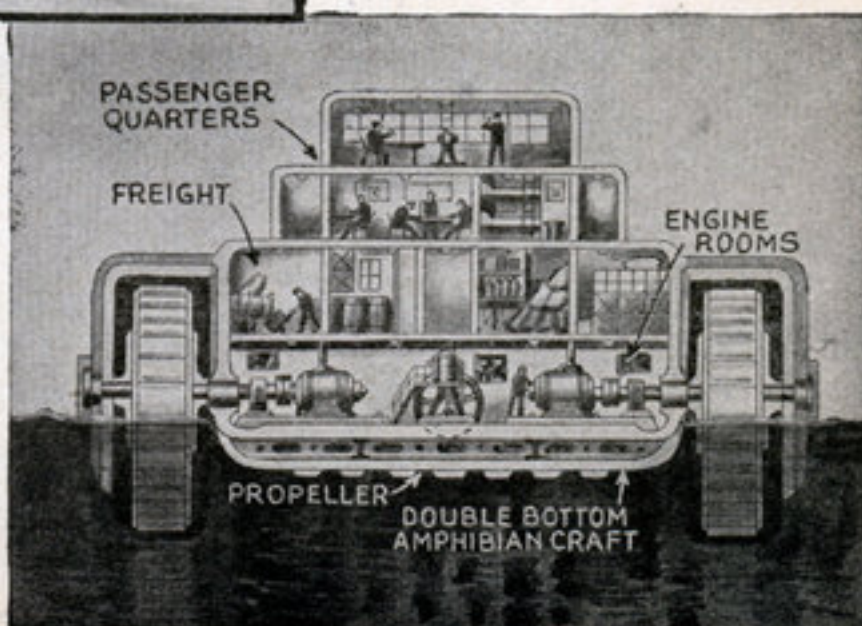
(Continued on page 254)



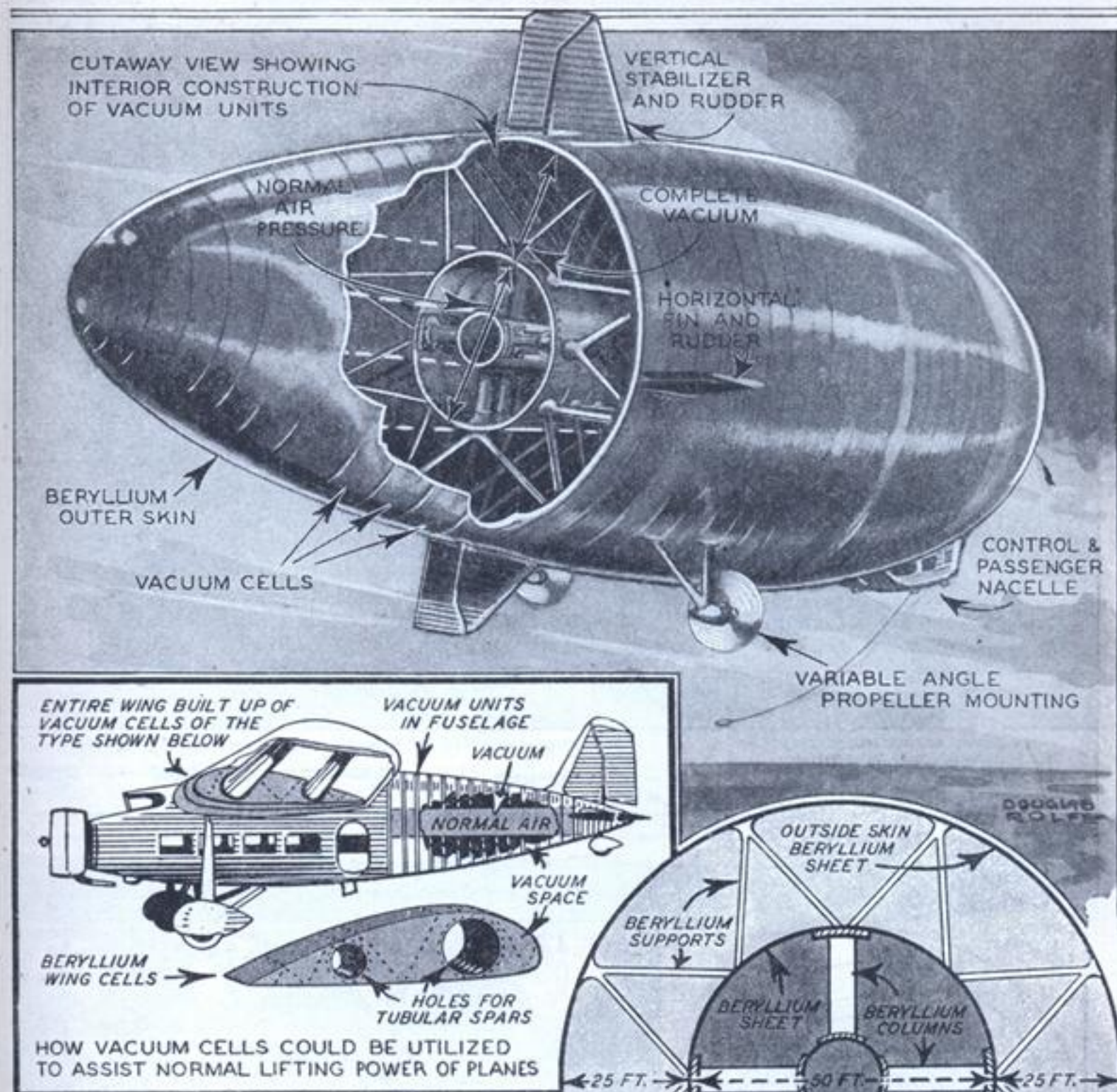
Rubber-footed busses are actually in use in Switzerland; and the principle, on a smaller scale, has been used to cross the Sahara and Central Asia.

● BEFORE the caterpillar truck came into extensive use, rubber feet had been in use on heavy vehicles, such as were used for artillery. The spreading of the rubber gave a wide area of contact, instead of the theoretical straight line only, in which a cylinder touches a flat surface. This saved the surface of the road, and made it possible to move much heavier weights. The caterpillar truck, distributing its weight over an even larger area of rolling iron plates, made it possible to move such huge structures as army "tanks" over rough country, and through a battlefield cut up by trenches, where wheels would be quite useless. Another combination has front steering wheels and

At the right, a proposed vehicle, for exploration where there are no roads, capable of crossing rivers and swamps.



Gasless DIRIGIBLE for Safe Air Travel



The upper drawing shows the structural details of the projected gasless all-metal dirigible. Beneath it is shown the arrangement of vacuum units in a large plane.

EVEN the most rabid enthusiast cannot defend the weakness of the hydrogen-fill dirigible. Death and destruction lurk in every cubic foot of it. Human ingenuity has failed to devise a means of making it safe and the prospect of riding the air with 2,000,000 cubic feet of a violent explosive over one's head is not alluring, at least to those who have had laboratory experience with the energetic hydrogen atom.

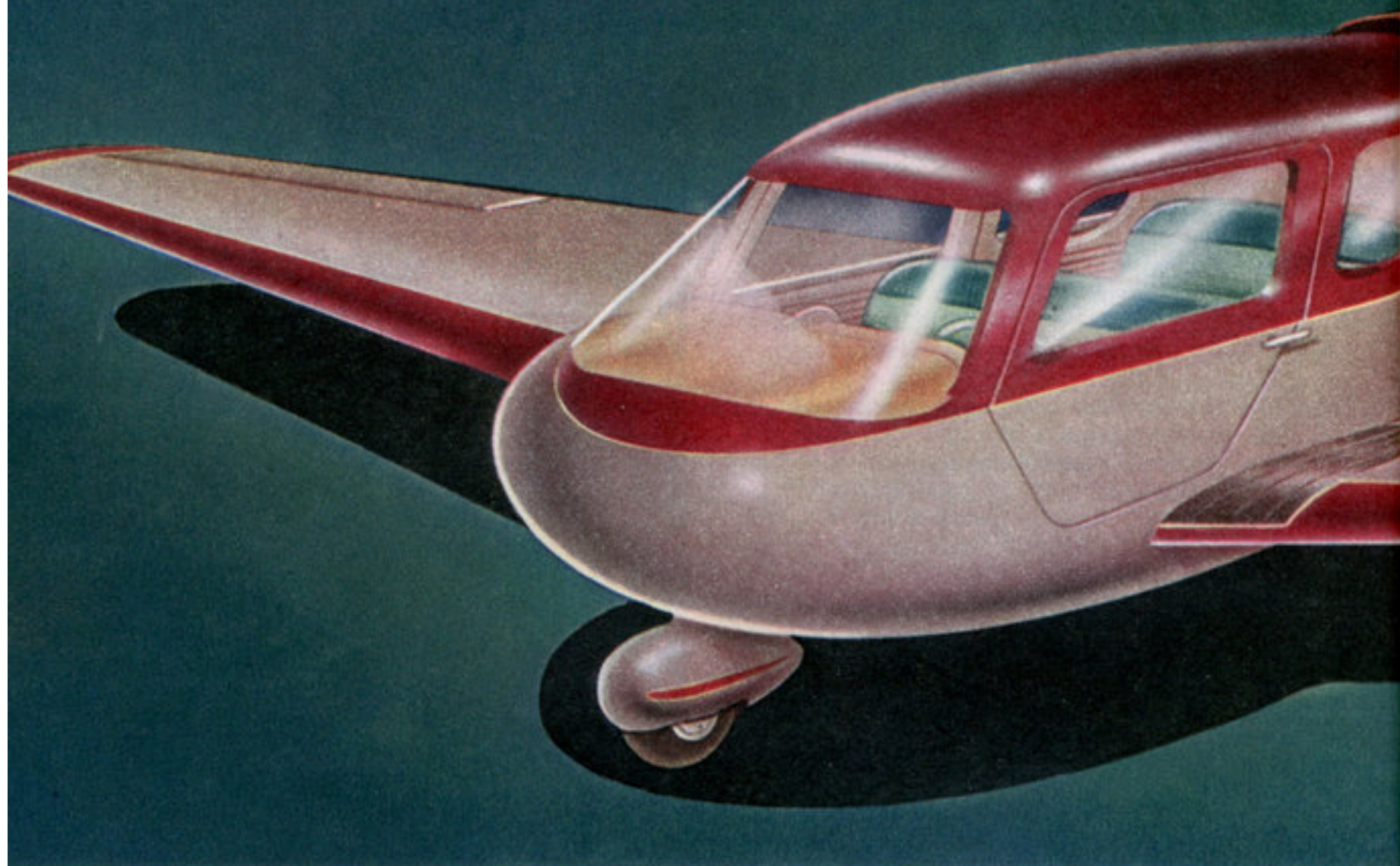
Of course, the thoughtless answer is: We shall use helium. That reminds the writer of the drunkard who came home and was told by his wife that not a crust of bread was in the house, whereupon the good wife was told to eat pie. Helium is far more than pie as compared with the cheap and plentiful hydrogen. There simply is not enough helium to go around.

A cross-section of the gasless dirigible. The inner unit will be filled with air at normal pressure, while beryllium girders will prevent the vacuum unit from crushing.

But why use any gas at all? Before we delve into this fascinating possibility, let us get the physics of it straight in mind.

Let us assume that we have a metal ball, say one foot in diameter. The ball is of tin and we connect it to a vacuum pump which sucks all of the air out of it. However, long

(Continued on page 184)



FIRST-PRIZE WINNER IN PROFESSIONAL CLASS INCLUDED

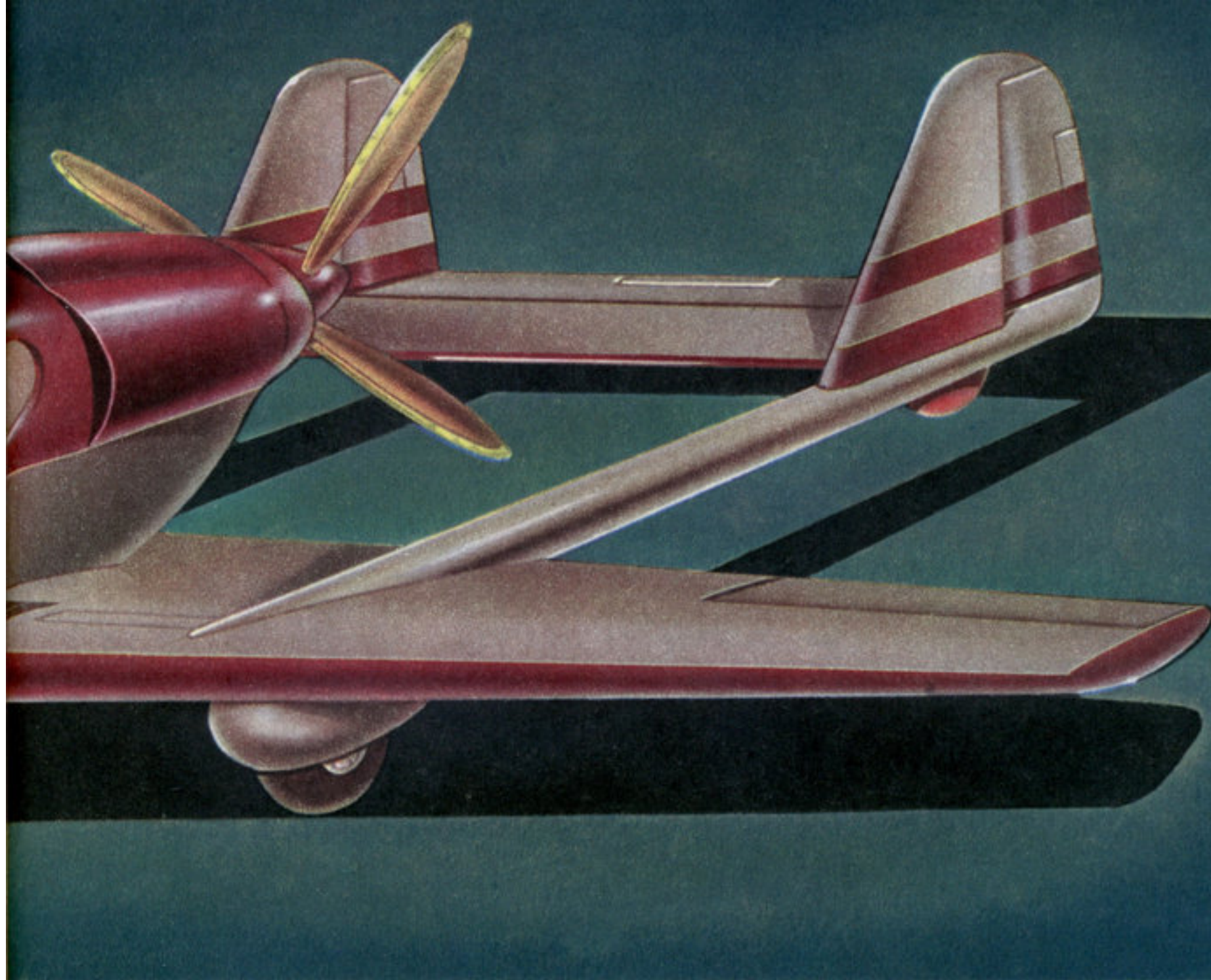
GENERAL DESIGN: Low-wing, four-place monoplane with twin tail booms, pusher propeller, and tricycle gear. **COST:** Around \$2,000.00. **PERFORMANCE:** Speed of around 115-135 m.p.h., range of 500 miles; good maneuverability and ground-handling characteristics; slow landing speed; and economy of operation.

COMFORT: Plenty of leg room, visibility, quiet operation; ash trays, sunshades, adequate baggage space; heating and ventilation equipment; split front seat, doors on either side; minimum of engine vibration. **SAFETY:** Tricycle landing gear gives easy landings and ground-handling characteristics; flaps permit slower

These Are the Planes

We asked the private flyers of tomorrow to write their own ticket. The analysis of 3,345 contest entries shows what they are looking for.

A DRAFTSMAN in the evergreen section of the Pacific Northwest wrote POPULAR SCIENCE MONTHLY last fall that of all the things he would like to see incorporated in his postwar private airplane, a foot throttle was on the high-priority list. He wanted other items of comfort, too, did Tom Phelan of Seattle—a cigarette lighter on the instrument panel, and arm



MANY FEATURES THAT INDICATE FUTURE POPULAR TRENDS

landings, spoilers give better glide control; booms enclose propeller; fire extinguishers, two-way radio; spinproof and stallproof features; hydraulic brakes; all knobs flush with the instrument board. ACCESSORIES: Dual or throw-over controls; landing lights, self-starter, heater, glove compartment; all flight instruments; safety

belts; emergency tail skids; wheel pants. This prize-winning design in the professional class was submitted by Donald J. Wheeler, an engineer in the Boeing Aircraft Company's plant at Seattle, Wash. It was selected for reproduction here because it embodies many features preferred by a majority of entrants.

You'll Fly After the War

rests built into seats for his passengers.

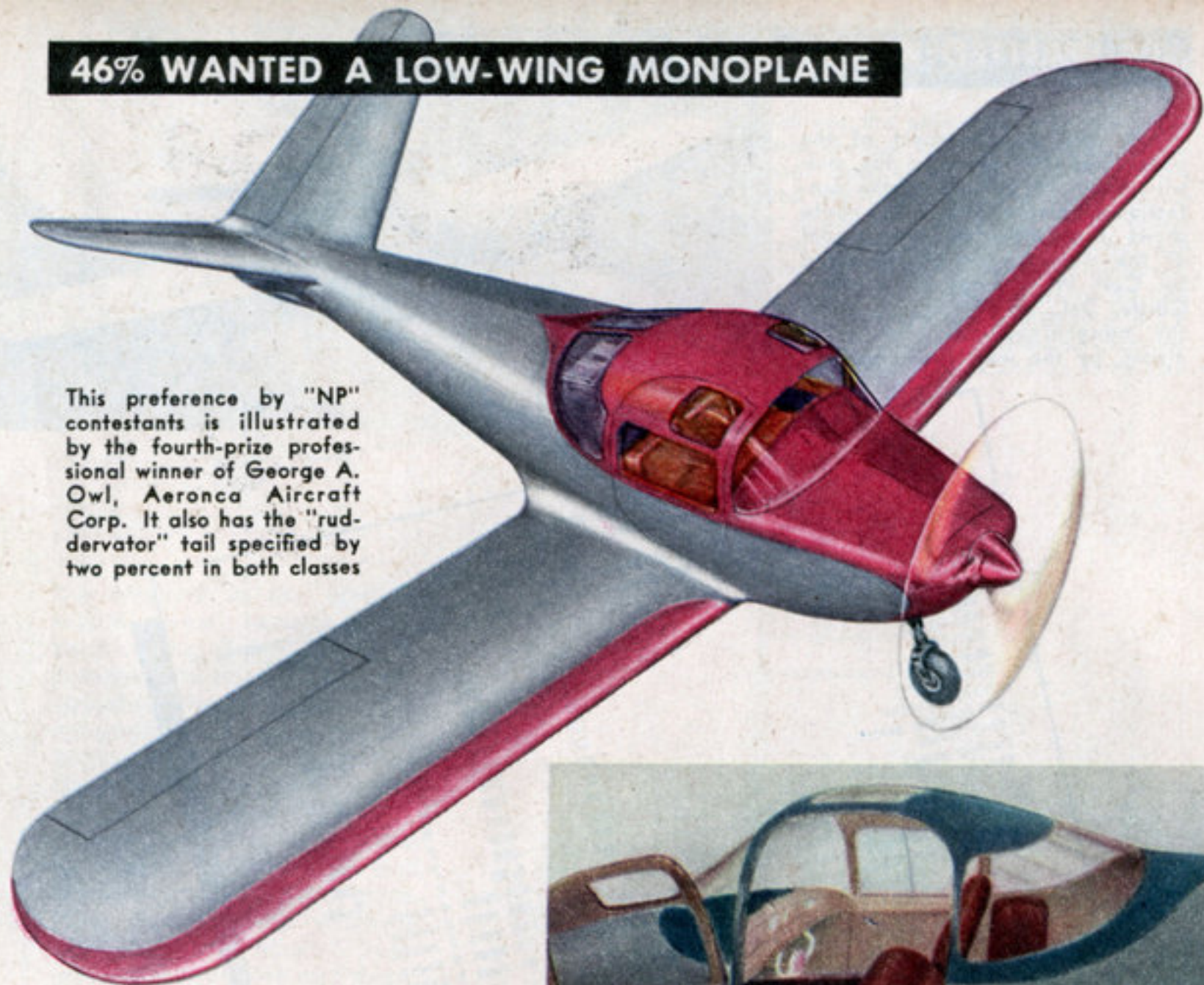
Tom Phelan was one of the many entrants in this magazine's "The Plane You'd Like to Own" contest, concluded September 30, who displayed a flair for merchandising. The automobile never would have sold in the millions if it had not had, first, utility; and second, comfort.

The personal-type airplane won't sell in

the postwar years unless it has both in generous proportions. Comfort runs a close second to safety—which is first on the list of demands, by the way—in the features tabulated by the board of judges from the 3,345 entries in the contest. After safety and comfort come good looks, practicability, and performance, in that order.

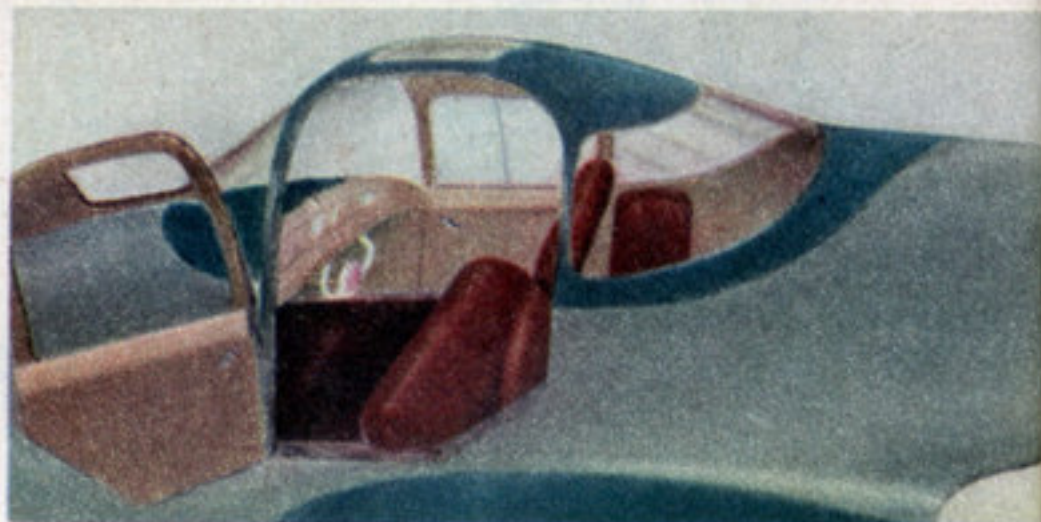
In the December issue we announced

46% WANTED A LOW-WING MONOPLANE



This preference by "NP" contestants is illustrated by the fourth-prize professional winner of George A. Owl, Aeronca Aircraft Corp. It also has the "rudervator" tail specified by two percent in both classes

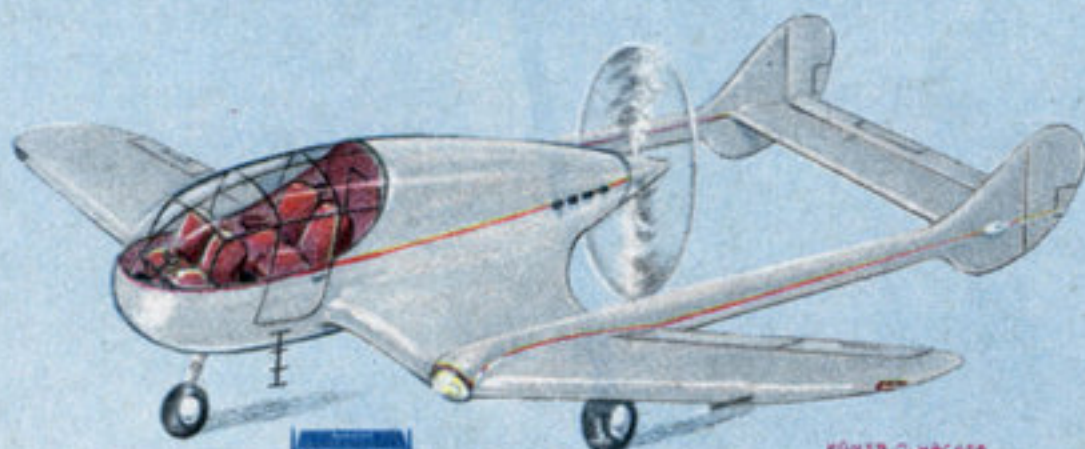
Automobile influence is apparent in the interior design of Owl's plane. Front seat holds three; rear, a child or a small adult



14% WANTED FOLDING WINGS

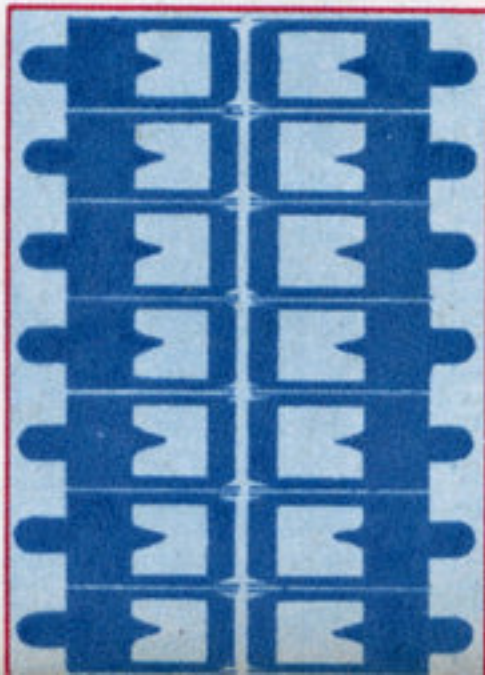
Many entries in both classes featured wings that could be folded, usually in conjunction with roadable design. When roadability was not considered,

the popular method of folding the wings was that used in the entry of Homer O. Hacker, "NP" second-prize winner, of Dayton, Ohio, whose original sketch is reproduced at left, below. In the drawing directly below, Hacker shows how compactly such planes, with their wings folded, can be stored in a hangar. This entry included many features that rated high preference among all the contestants



104

LENGTH - 25'
SPAN - 37'
HEIGHT - 7 1/2'



tainment during those long hours in the air on cross-country trips. And there was something else behind that, too: a simple "homing loop" on an airplane, tuned to a commercial-band broadcasting station, can be of inestimable value in air navigation.

The enemy knows that. That's why he shuts off his broadcasting stations when our bombing fleets take off to saturate his war industries with explosives.

There were other items of comfort specified: rear-view mirrors, so a man wouldn't have to twist and turn in his seat to see what was behind him as he made a turn or a climb; better ventilation, glove compartments, ash trays, sunshades, heaters, extra leg room, and plenty of baggage room. The owner of a personal-type air-

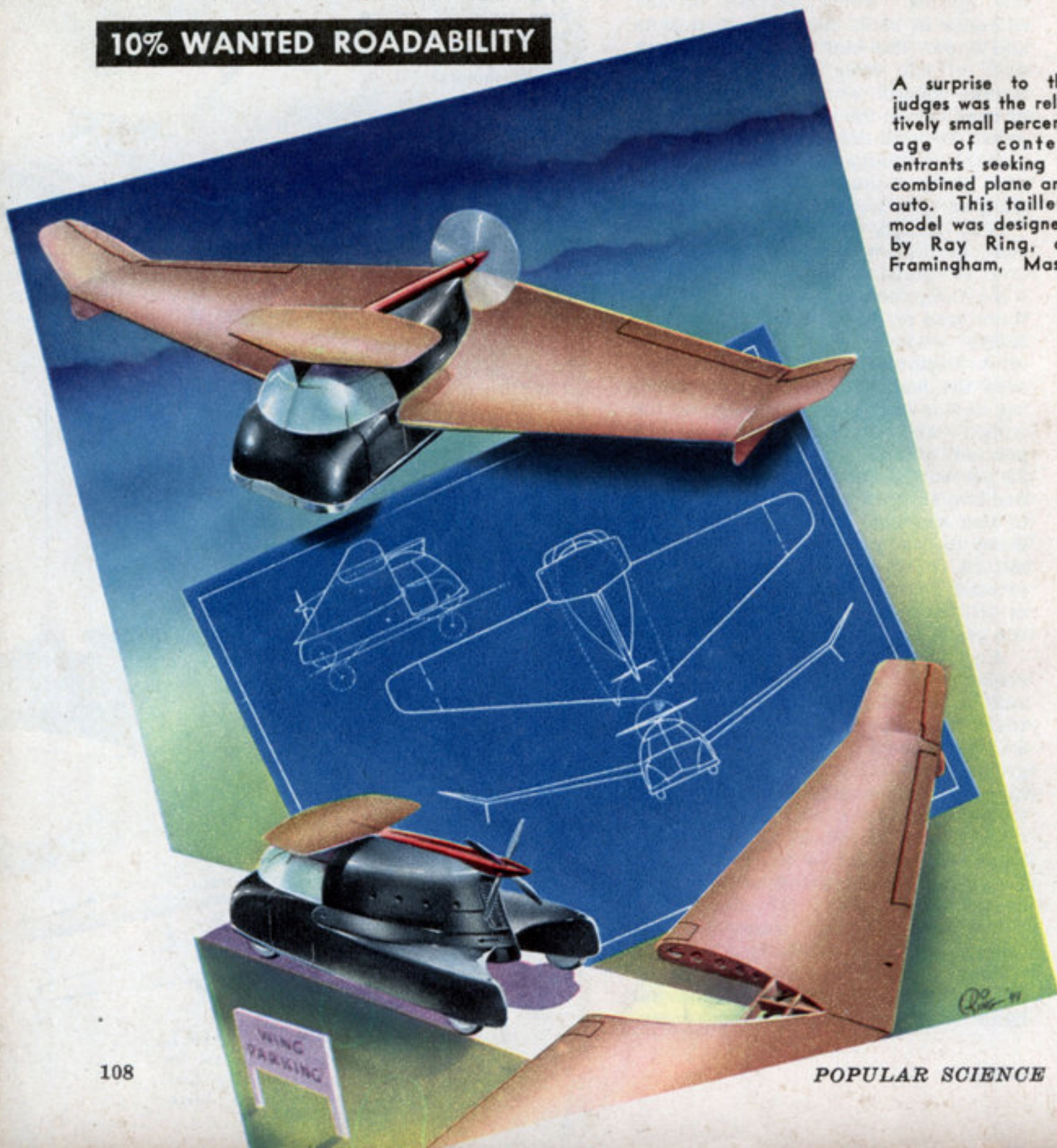
plane can't get full utility out of it unless he has space to stow away his fishing tackle, golf bag, a picnic hamper, bags, and Junior's playthings.

Homer O. Hacker, of Dayton, Ohio, who collected \$500 in War Bonds as second-prize winner in the professional class, wanted built-in hangers for coats and spare jackets. And, to simplify the job of tying down his aircraft for the night, he included a steel roll-up device for the underside of the wing that could be attached to a stake or other object.

Several designers, including Harold B. Stucky, of South Hutchinson, Kan., winner of a \$25 War Bond in the nonprofessional class, specified a ladder for easy entrance to his airplane. Other entrants had their

10% WANTED ROADABILITY

A surprise to the judges was the relatively small percentage of contest entrants seeking a combined plane and auto. This tailless model was designed by Ray Ring, of Framingham, Mass.



ladders sliding out of the floor or door, and even out of the wing. Going the whole way on comfort, some designs were complete with built-in beds.

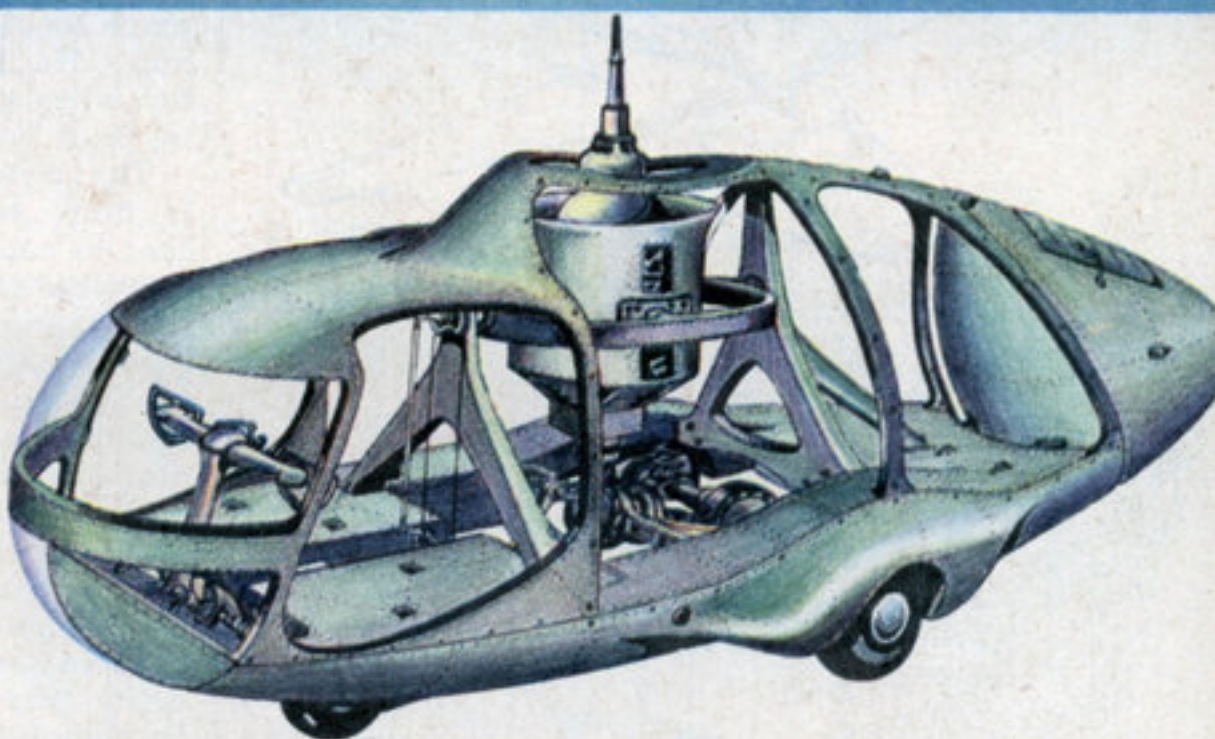
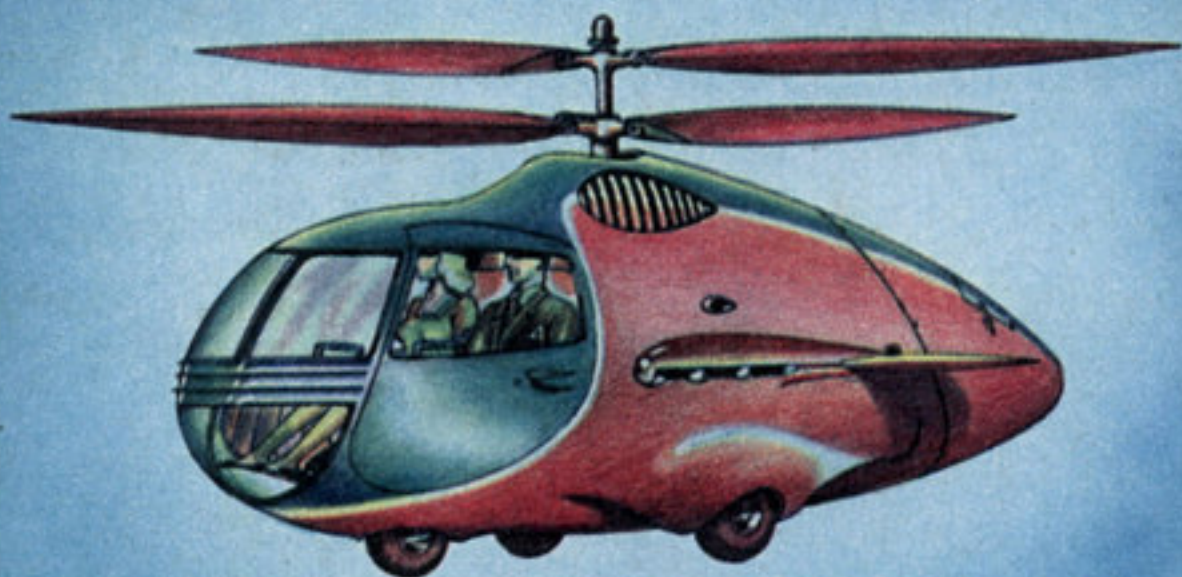
More than half the non-professionals wanted four-place planes, while 43 percent of the professionals said that would be the amount of seating capacity they would require. Several designers suggested a front seat wide enough for three people and a small fold-up seat behind it.

But—and here was a poser for the judges—only eight percent of the non-professionals and six percent of the professionals wanted planes with two controls instead of three. A two-control airplane dispenses with rudder pedals by integrating the rudder control with the ailerons or by carrying a fin so designed as to overcome the normal “yawing” movement in a turn.

The chances that your postwar plane will have a wing attached to the bottom, instead of to the waist or the top, of the fuselage are pretty good, judging by the contest preferences. Almost every second one of the nonprofessional entrants preferred the low wing. Only every fourth one of the professionals wanted it. If you fly an airplane, you know what the choice between the low wing and the high wing comes down to: largely a personal preference.

In a turn, a high wing blanks out the area into which you are turning. A low wing blanks out your view of the ground. A high wing has “pendular stability.” A low wing provides a lot more all-around visibility. A high wing supplies clearance over such ground objects as bushes. A low wing is cleaner and has less “drag” because normally it has no struts.

The nonprofessional contestants favoring high-wing monoplanes ran to 18 percent, while the professionals totaled up to 36 percent; the mid-wing type enjoyed a vote of eight percent among the nonprofessionals and 17 percent among the professionals.



Another surprise was the small number of contestants pinning their hopes on rotating-wing aircraft. Fifteen percent of the nonprofessionals and 10 percent of the professionals favored helicopters. This exceptionally detailed design and construction plan was entered by Cpl. Robert W. Huzzard, of Wilmington, Ohio. It has contra-rotating rotors

Then there was the vote on amphibians. The amphibian is a sort of jack-of-all-trades. If a smooth landing surface is available on the ground, the amphibian can use its wheels. If it can't find smooth ground, or if the pilot simply chooses to use a water surface by preference, it can be put down on a lake, a river, or the protected blue water of a cove. The pilot who likes to operate off water makes an interesting discovery when he begins exploring the surface of continental United States: it is pitted with depressions full of water. One pilot using an ordinary seaplane flew all the way across the northern tier of states from the Atlantic to the Pacific and never lacked a landing place.

One out of five of the professional entries

road and for flight, was mounted in the fuselage.

Incidentally, but 14 percent of the non-professionals and seven percent of the professionals wanted folding wings.

The professionals practically ignored airplane construction incorporating plastics or plastic-impregnated plywood. Seven percent of them liked plastics. But 20 percent of the nonprofessionals toyed with the idea of plastics.

The choice on aircraft prices in relation to speed, carrying capacity, and solidity of construction was one of the biggest surprises of the contest. It was natural to assume that the public would want a low-priced airplane. A decade ago a Government department, in fact, publicly encouraged manufacturers to produce a "\$700 airplane" for the average family purse in the thought that a modest price would lead to more widespread private flying by putting airplanes within the reach of a larger proportion of the population.

But the contestants said most emphati-

cally no, they preferred to buy planes priced in the same class as the better automobiles. They wanted nothing under \$1,000 if it didn't pay for a better type of aircraft, and they backed up their statement with designs that included luxury items. Luxury items cost money.

POPULAR SCIENCE MONTHLY is proud to have sponsored the "Plane You'd Like To Own" contest. It set a high-water mark in surveying the public's tastes in postwar personal-type aircraft. Magazines and newspapers throughout the country printed news stories about it. Undoubtedly, it will contribute to the advanced thinking going on in the rooms marked "No Admittance" in factories where tomorrow's designs are in the making.

Planes incorporating many of the features in the plane you'd like to own will be rolling off the assembly lines pretty soon.

When, at last, you are able to walk into a salesroom on "airplane row" and pick out a sky runabout, it will show the results of this sampling of private-flyer opinion.

ENTRIES INCLUDED MANY NOVEL CONSTRUCTION IDEAS

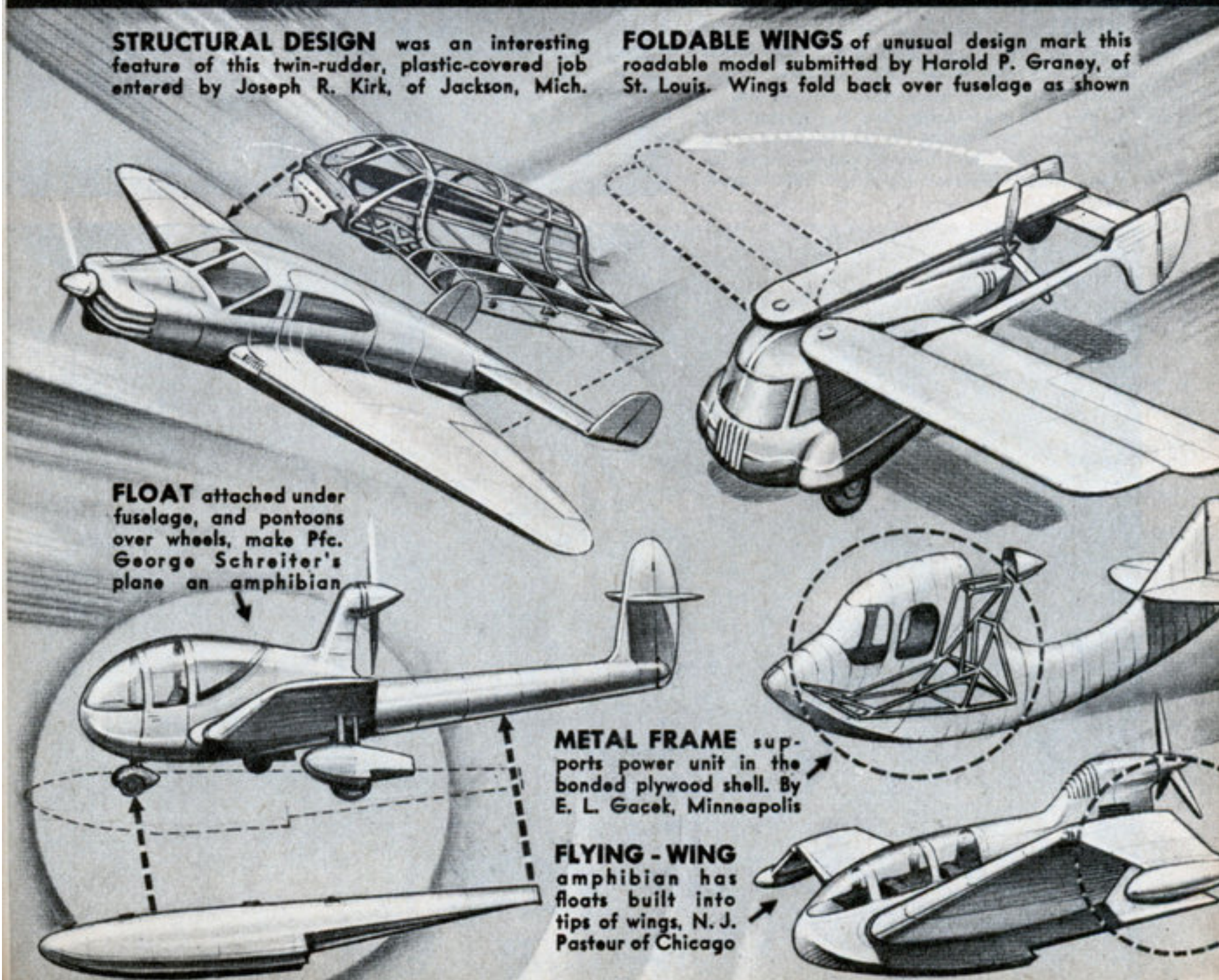
STRUCTURAL DESIGN was an interesting feature of this twin-rudder, plastic-covered job entered by Joseph R. Kirk, of Jackson, Mich.

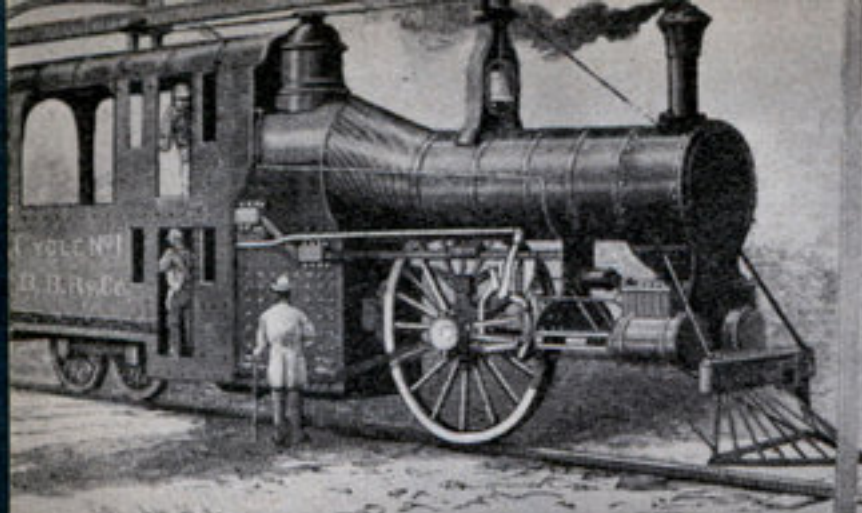
FOLDABLE WINGS of unusual design mark this roadable model submitted by Harold P. Graney, of St. Louis. Wings fold back over fuselage as shown

FLOAT attached under fuselage, and pontoons over wheels, make Pfc. George Schreiter's plane an amphibian

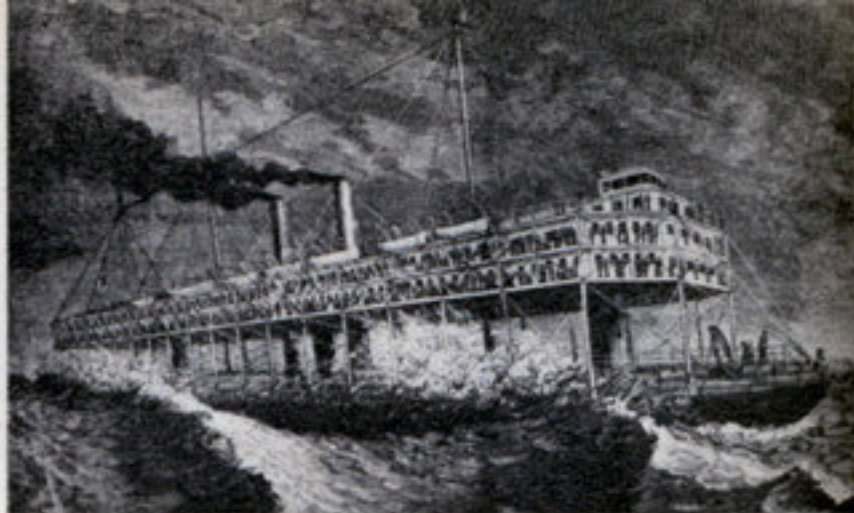
METAL FRAME supports power unit in the bonded plywood shell. By E. L. Gacek, Minneapolis

FLYING - WING amphibian has floats built into tips of wings, N. J. Pasteur of Chicago



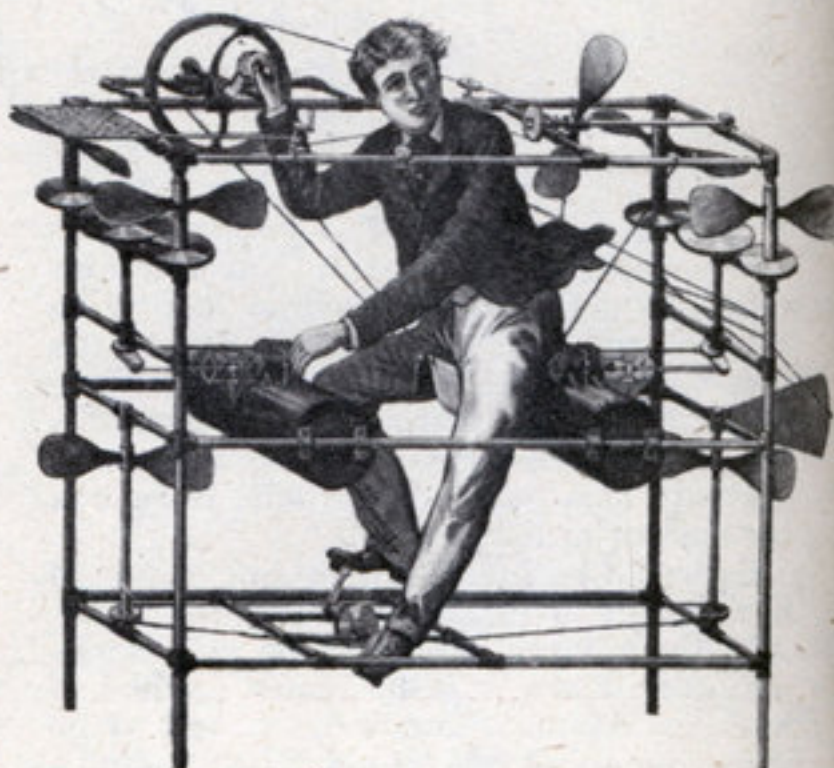


Boynton Bicycle Locomotive built in 1889 was tested in Gravesend, Brooklyn, on one overhead and one ground rail. Arrangement was supposed to reduce weight, friction and save power on curves.



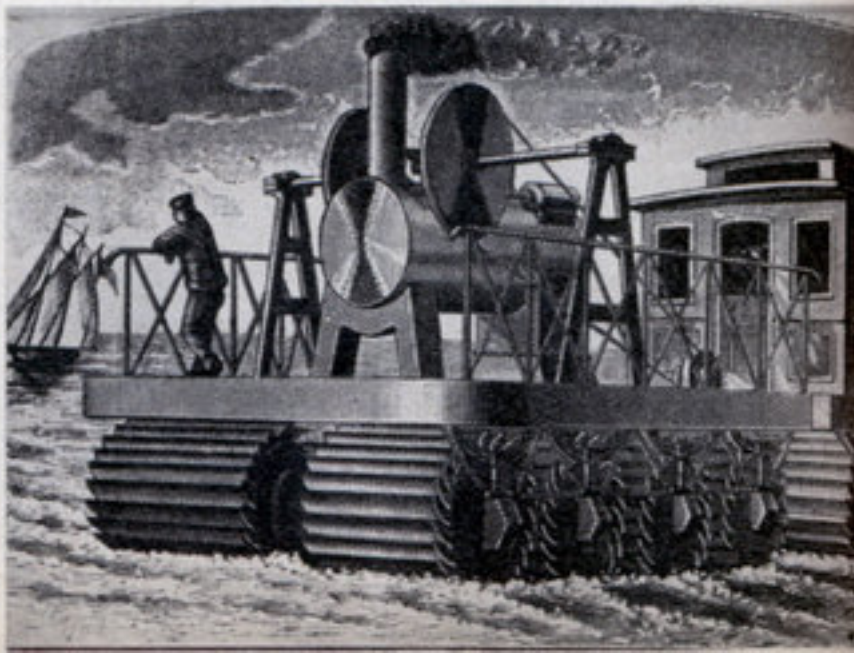
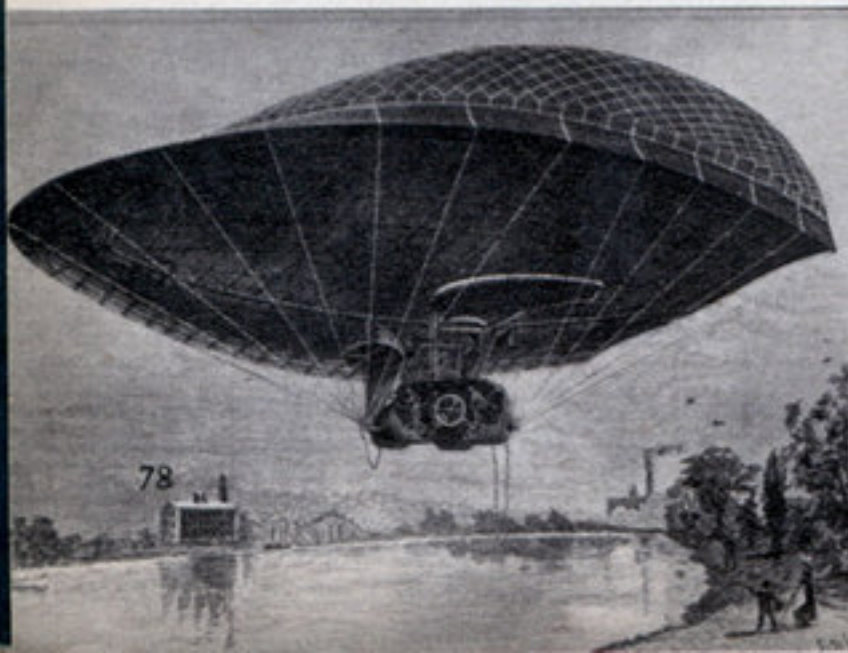
Whaleback Passenger Steamer having the form of a submarine with passenger steamer built on top was invented by Harold Avery in 1891. It was actually constructed for the Columbia Exposition.

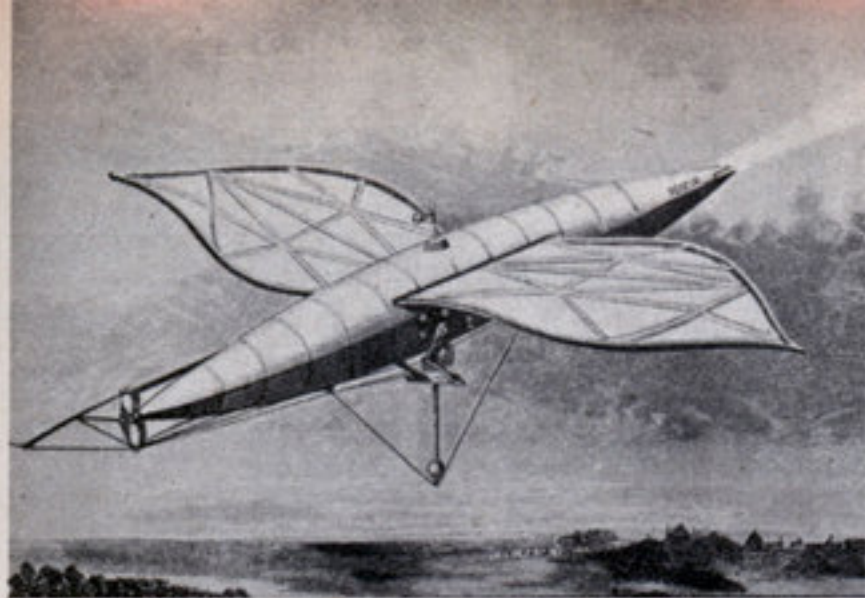
Vehicle **C**oncoctions



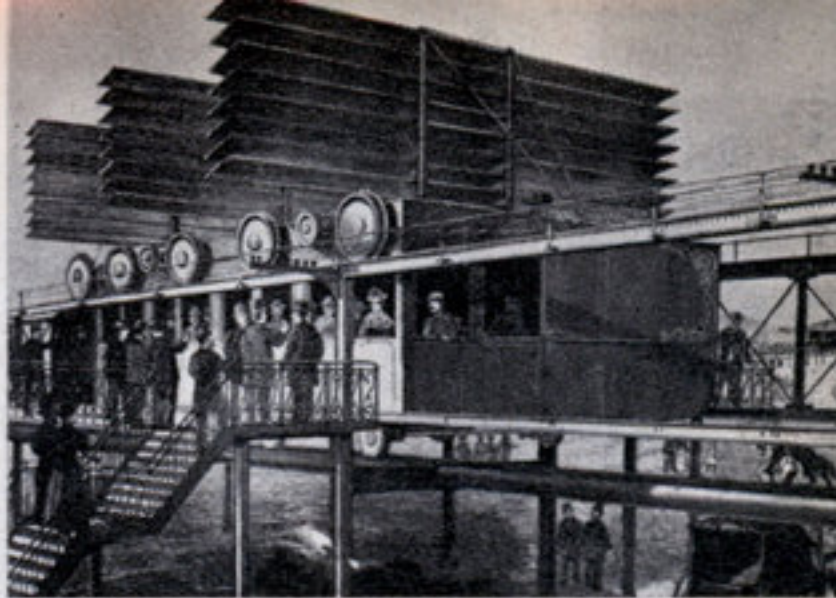
Bicycle Airship designed to fly in any direction was the fantastic brainchild of Herman Rieckert in 1889. Bicycle apparatus in pilothouse flapped side and center wings, providing motive power.

Marine Train of 1873, propelled by a locomotive on cylinder-like paddle wheels, was intended to travel as fast on water as does a train on land. Its inventor was a Dutch engineer, M. A. Huet.





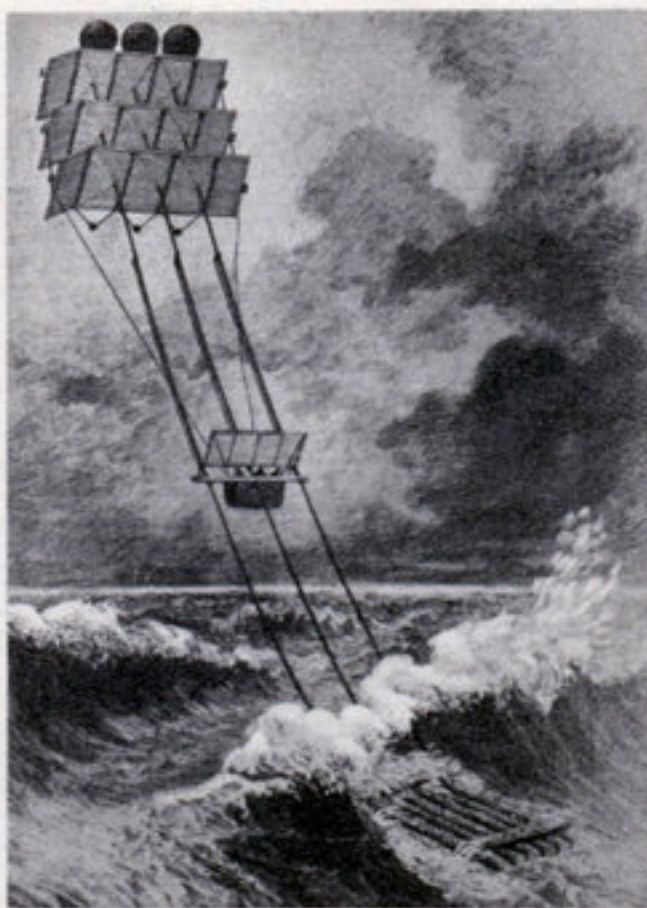
This Russian invention didn't work. Steam-powered flying machine of 1883 had propeller in rear, two great wings. Nose admitted air for combustion of fuel; pendulum provided equilibrium.



Chase-Kirchner Aerodynamic Railroad of 1894 was a combination of an electric high-speed railroad and aeroplane. Inventors claimed it could attain 150 mph on a straight track, never tested it.

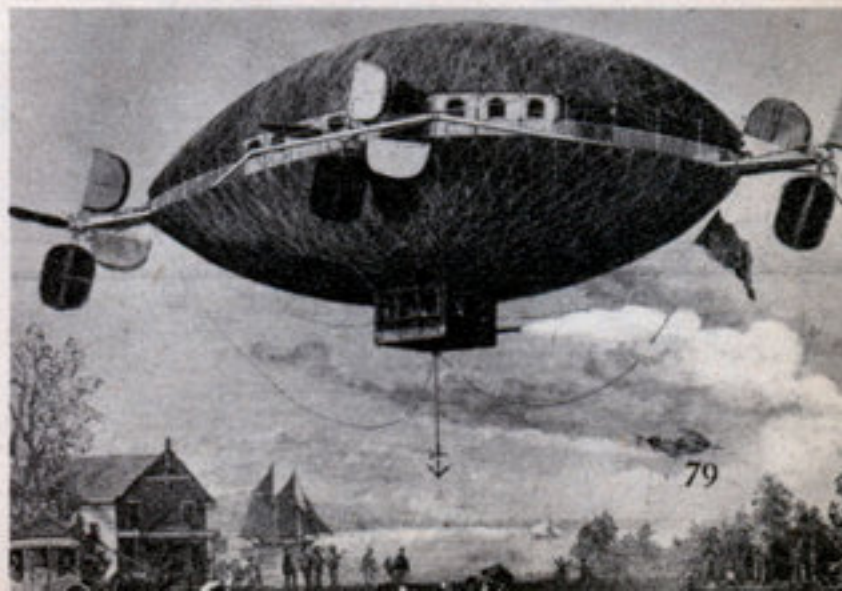
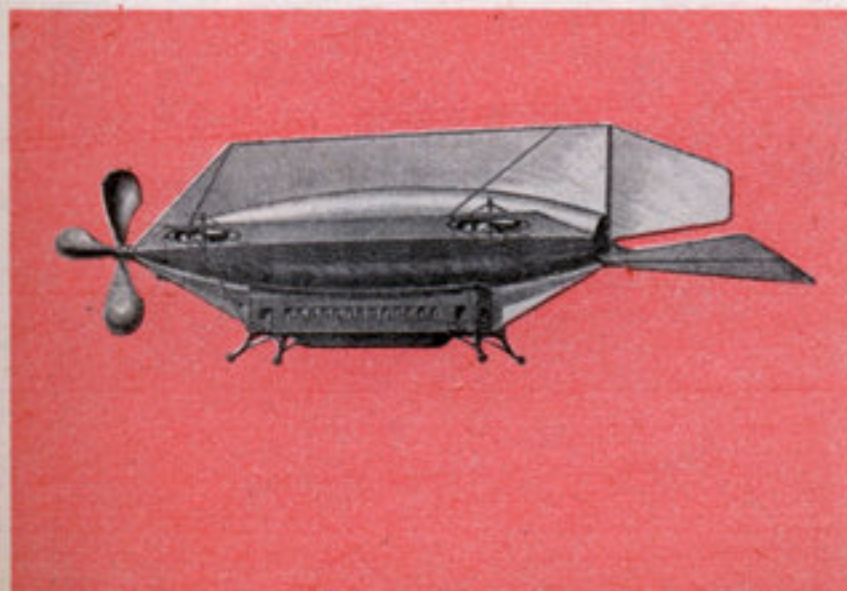
Aerial Machine invented by W. O. Ayres in 1885 got its power from air compressed to 3,000 lbs. per sq. in. in two drums. Air was supposed to feed through tubes to motors, last for several hours.

Aerial Railway for towing craft on land and water got its power from wind on wings held up by balloons. Passenger basket was tied midway on towing cables. Invented in 1890 by David Thayer.

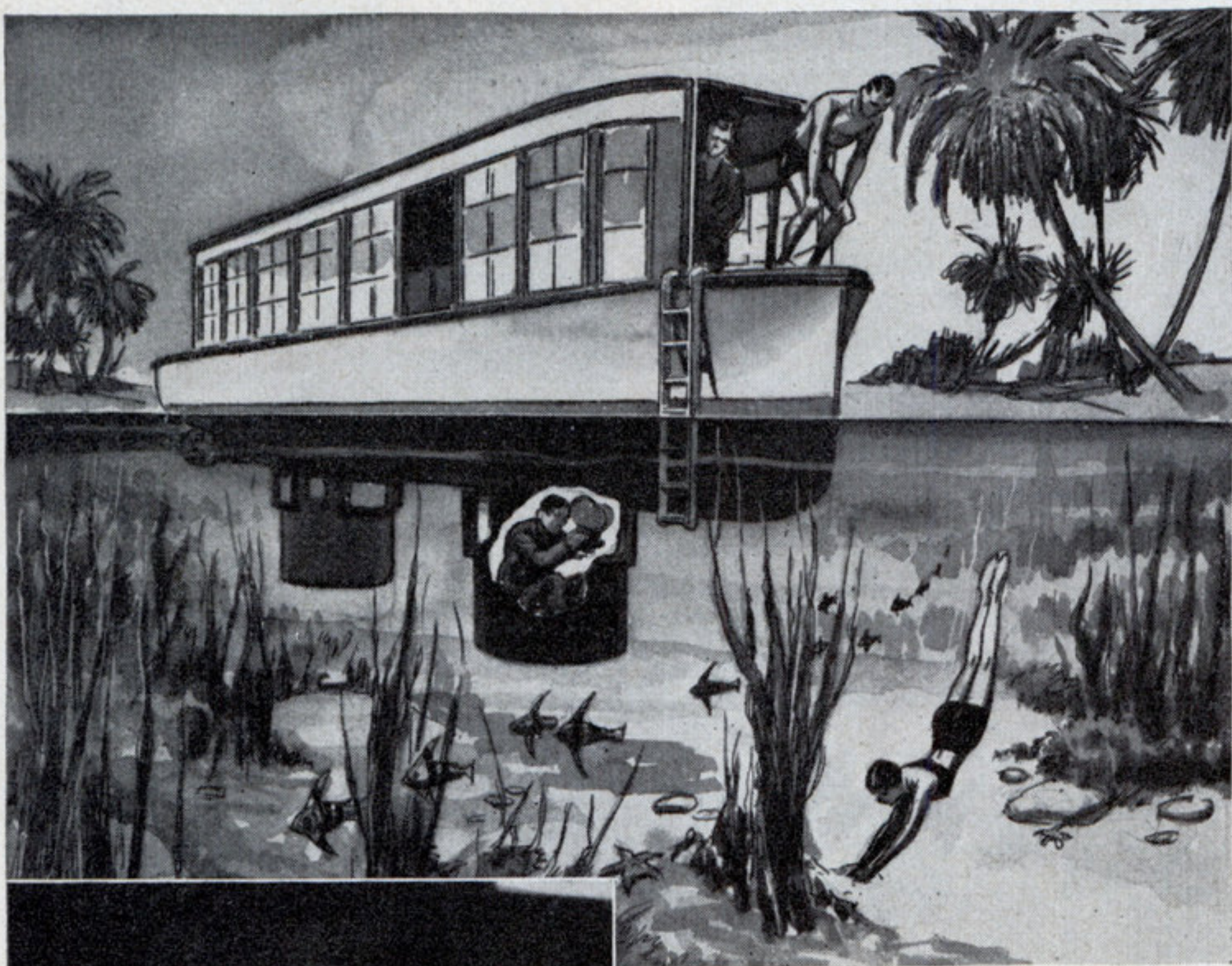


Pennington Aluminum Airship of 1891 had large sail over its gas bag which could be manipulated like that of a boat. It had propeller in front for motion, two propellers in each side wing.

Spheroid Dirigible of 1887 had central compartment for passengers with buoyancy chamber at top and bottom. Engine was placed in hollow shaft in center connected to pilothouse below.



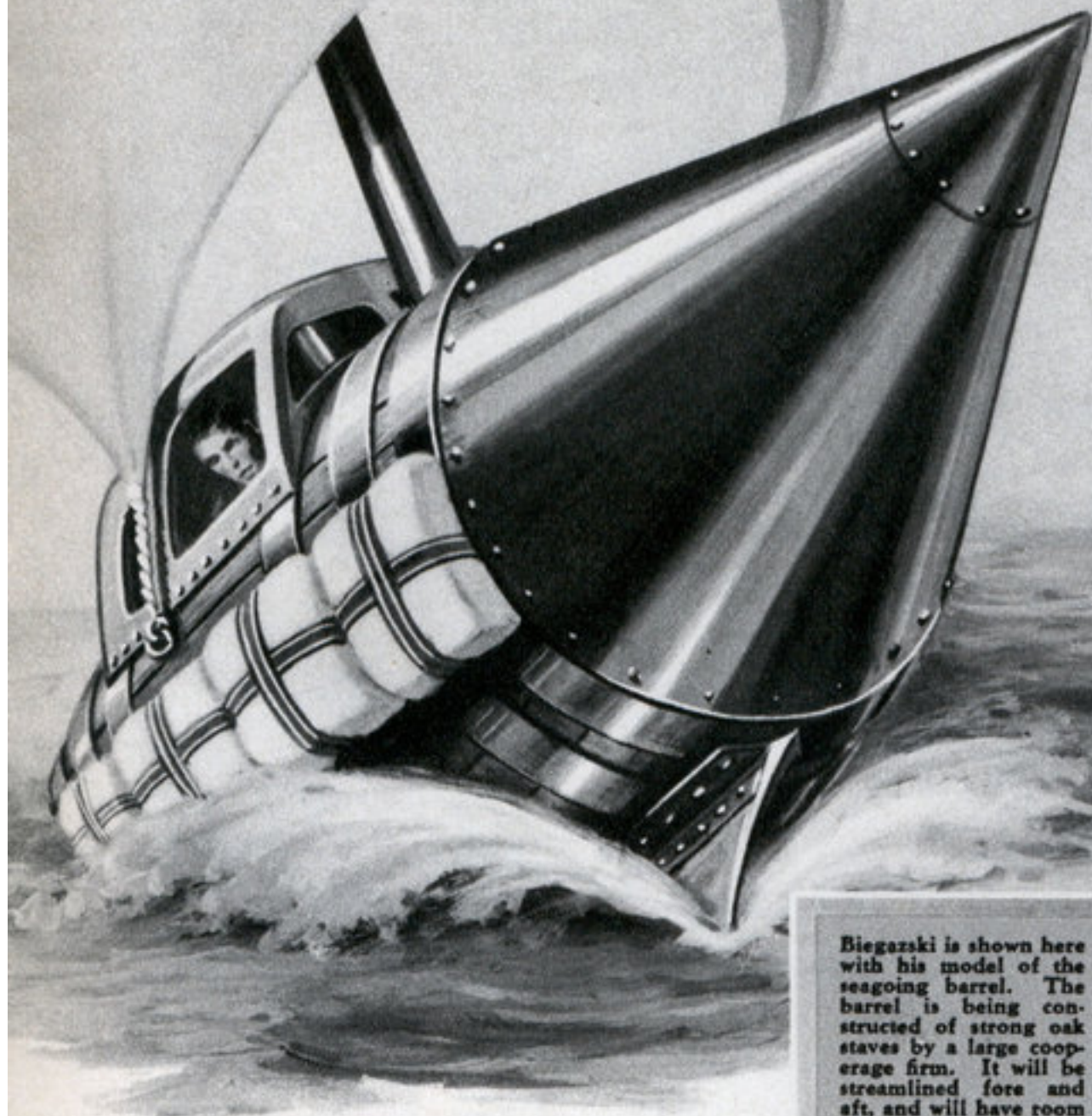
Underwater Scenes Filmed from Odd Boat



Cameraman in one of the underwater chambers of the novel boat. The drawing above shows a scene being photographed

SUSPENDED like twin keels from the hull of a specially designed boat, cylindrical steel chambers fitted with thick glass windows enable motion-picture photographers at Silver Springs, Fla., to make a series of underwater movies. When a scene is to be taken, a cameraman descends from the boat deck into the submerged photographing chamber. Swimmers then dive from the deck to perform their feats in full view of the lens, as depicted above. The electrically propelled craft can be moved about during a scene to permit close-ups and various camera angles.

Veteran Dares Atlantic In Barrel Boat



The Atlantic Ocean, conquered by scores of odd ships, is now challenged by nothing less than a barrel. Ernest Biegazski is the daring navigator who plans to use this means of battling the elements. When completed, the streamlined barrel will appear as at left.

A SEA-GOING barrel—it sounds fantastic, but not to Ernest Biegazski, Buffalo, N. Y., war veteran, who plans to use just such a vessel to cross the Atlantic. The daring trip, according to his calculations, will not take more than 40 days. The oak barrel, which will comprise the hull of the vessel, will be nine feet long with a diameter of six feet, eight inches. A 600-pound keel will furnish the ballast. A hollow mast, 20 feet high, will carry the sail, a simple rig of approximately 300 square feet. A glass-enclosed hatch which will provide exit to the narrow deck. During stormy weather he will reef his sail, seal the hatch, and bob about safe as a cork.

Though the crossing is expected to take 40 days, Biegazski is taking food for sixty.

Biegazski is shown here with his model of the seagoing barrel. The barrel is being constructed of strong oak staves by a large cooperage firm. It will be streamlined fore and aft, and will have room in the hold for provisions and water for sixty days. Biegazski plans on crossing in forty days or less time.



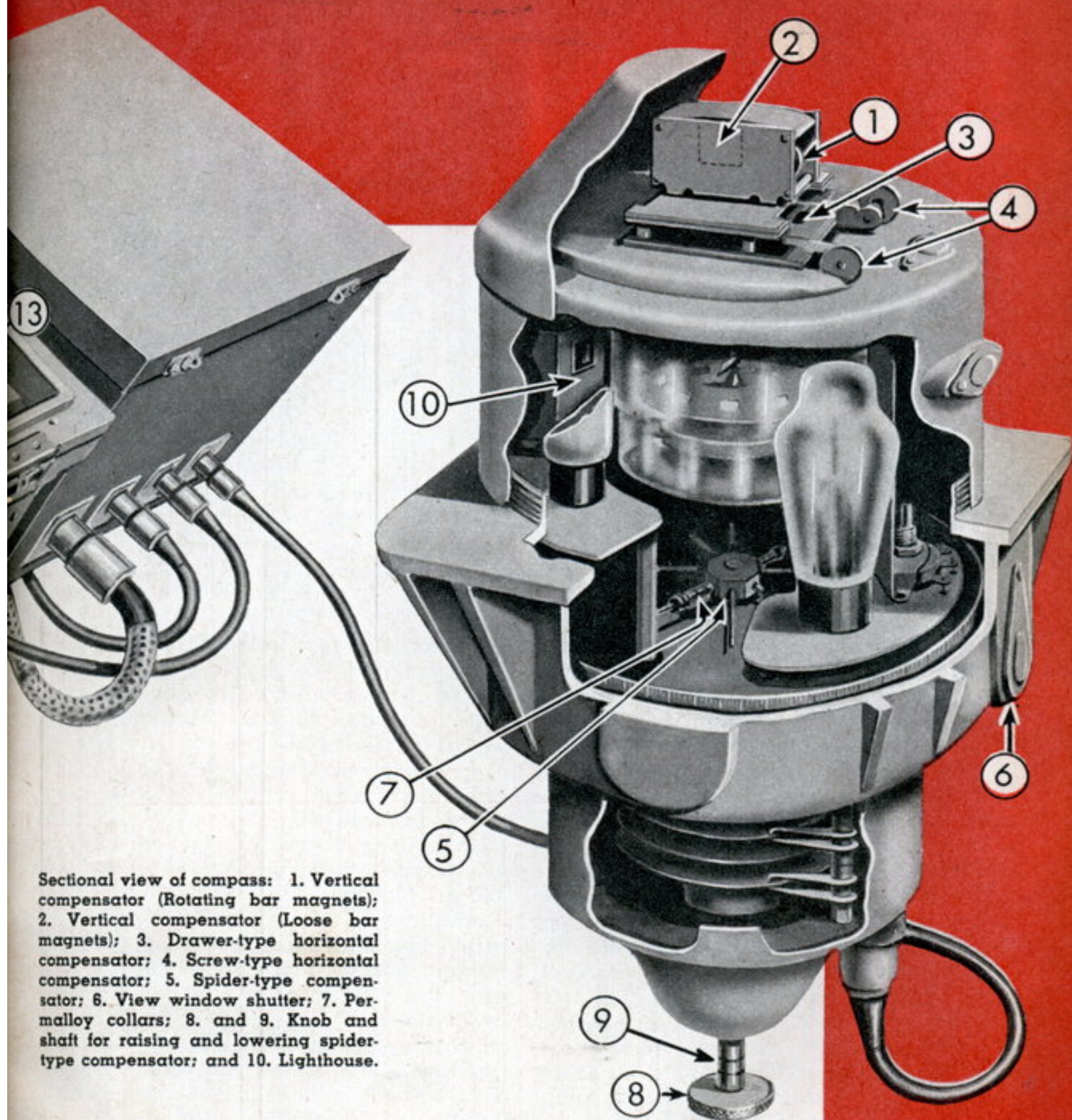
HIGHWAY "BEAM" FOR MOTORISTS



Key to parts of plotting unit: 1. Main map scale adjustor knob; 2. Intermediate map scale adjustor knob; 3. Pencil; 4. Pencil adjustment clamp; 5. Pencil adjustment knobs; 6. Azimuth dial; 7. Pointer swing control knob; 8. Total miles counter; 9. Coordinate miles counter; 10. Individual coordinate miles-counting preset keys; 11. Coordinate miles-counting master key; 12. Coordinate miles-counting shutter reversing keys; 13. Crosswise lead screw; 14. Map scale dials.

War-born device will guide peacetime motorists unerringly to their destinations—or plot their course as they go along.

EARLY one morning last year, just before sunrise, two men in a jeep found themselves lost in Washington. That is a horrible fate which can happen to anyone and often does, but in this case it was serious. In the back seat of the jeep was installed the first model of a secret new device which was being delivered under cover of darkness to the Army Engineer Board at Fort Belvoir, Vir-



Sectional view of compass: 1. Vertical compensator (Rotating bar magnets); 2. Vertical compensator (Loose bar magnets); 3. Drawer-type horizontal compensator; 4. Screw-type horizontal compensator; 5. Spider-type compensator; 6. View window shutter; 7. Permalloy collars; 8. and 9. Knob and shaft for raising and lowering spider-type compensator; and 10. Lighthouse.

ginia. It had to be there at 8:00 a. m. to be inspected by a full board of high Army officers. But the two men in the jeep, newcomers to Washington, were stymied.

At last they came upon a gas station that was open and pulled in to get directions. The attendant gave them the information they wanted and a road map—and the road map gave them a bright idea. Turning to the device in the back seat, they made some calculations, slipped the road map into the device, and drove without hesitation straight to Fort Belvoir.

The wonder machine which made that possible was the Odograph, an instrument which automatically plots the course of a moving vehicle or guides it to a given point. It's the first successful device for instantaneous map-making in the field, and therefore a major contribution to the winning of the war. It draws a map that all can understand while the vehicle is in motion.

The Odograph consists of three principal parts: an electronic magnetic compass, a power pack, and a plotting desk on which a moveable pencil actually draws the maps. All

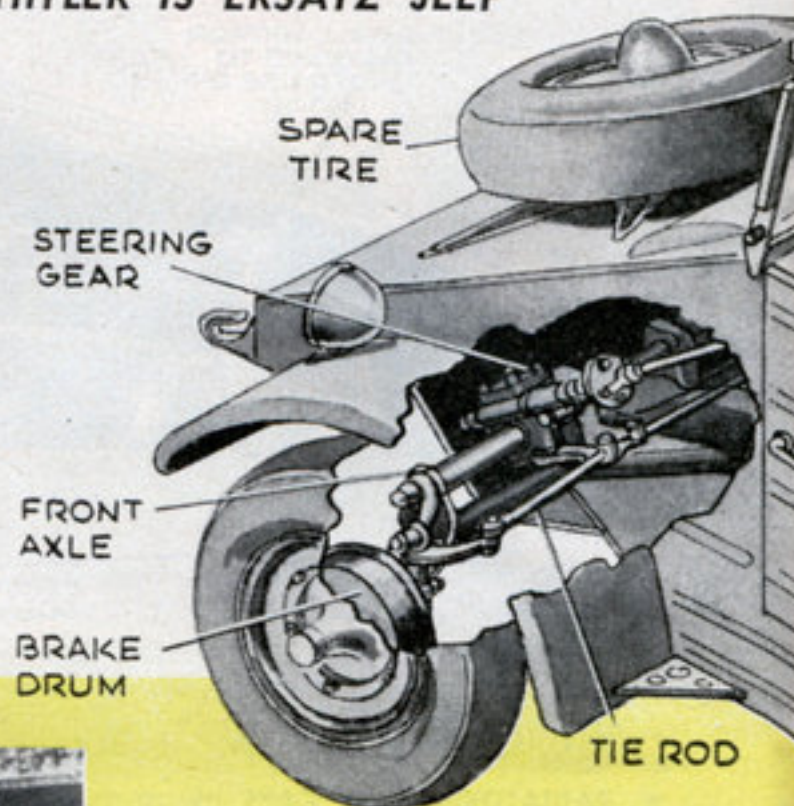
END OF ANOTHER NAZI DREAM . . .

THIS WAS GERMANY'S FLIVVER

"PEOPLE'S CAR" PROMISED BY HITLER IS ERSATZ JEEP

BACK in the thirties, when Germany's war preparations were weighing heavily on her people, Nazi leaders dangled before the public a vision of a wonderful "poor man's car" soon to pour from the factories. It was to be an automotive marvel, light, fast, roomy, and inexpensive; and it would reward Germans for the low wages, long hours, and shortages.

Never made in quantity for civilians, this *Volkswagen* has turned up on battlefields as an inferior version of our jeep. Captured models, tested and taken apart by U.S. experts, show that the car is less rugged and versatile than its American prototype, but ingenious in design and economical to run. Power is supplied by a four-



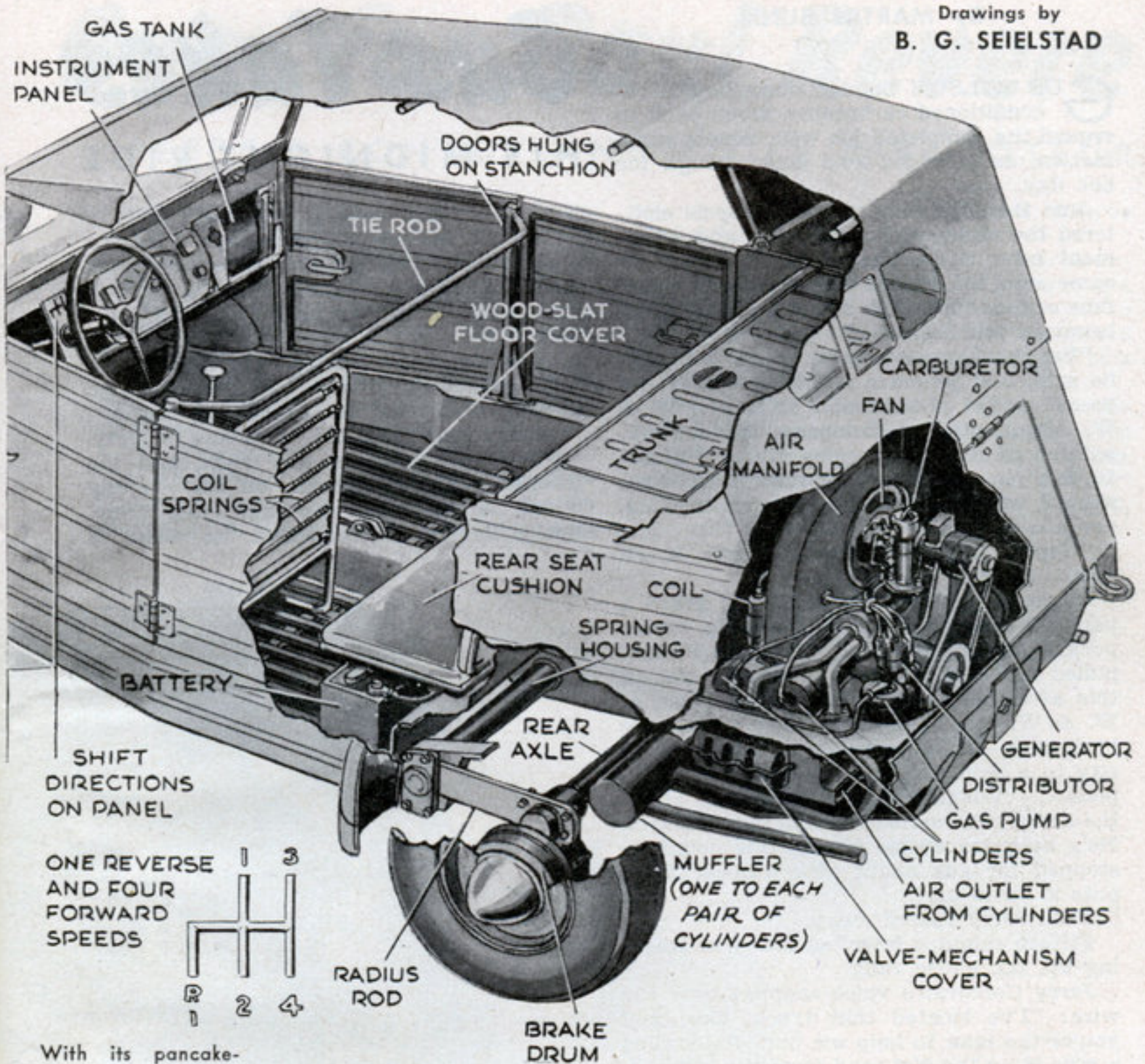
cylinder opposed motor, mounted at the rear and driving the rear wheels. The engine develops some 24 hp. and is cooled by a blower and housing that delivers air to the cylinders. Top speed is above 60 m.p.h., while gasoline mileage at this speed is about 33 miles per gallon. The fuel tank, mounted in front of the dash, holds six gallons. A steel backbone replaces the conventional chassis, and springing is accomplished by means of coil springs located within transverse, pipelike housings.

A civilian model of the car, shown above, was publicized by the Nazis as within reach of practically every worker's pocketbook. But the promised mass production was put off

Converted for military uses, the Nazi flivver serves the Germans as a light general-purpose vehicle. This one was captured in Africa and brought to this country for testing. It hasn't the four-wheel drive or ruggedness of our own justly famous jeep

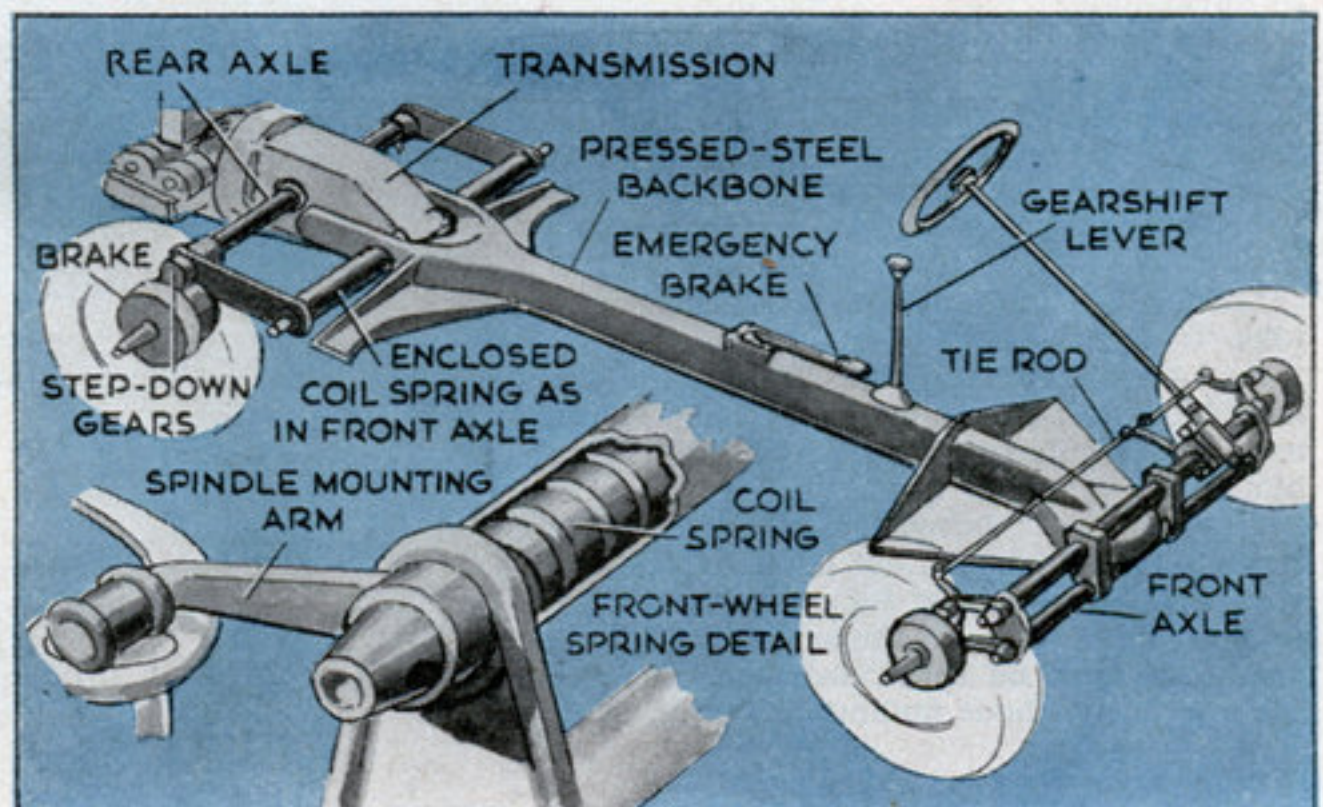


Drawings by
B. G. SEIELSTAD



With its pancake-type motor located in back of the rear axle, the car has ample stowage space in front. Note that radius arms from rear axle give spring play and transmit start-and-stop thrust

A single steel member down the middle forms the chassis. Controls for transmission and brake run through the backbone. Reduction gears are placed beside each rear wheel

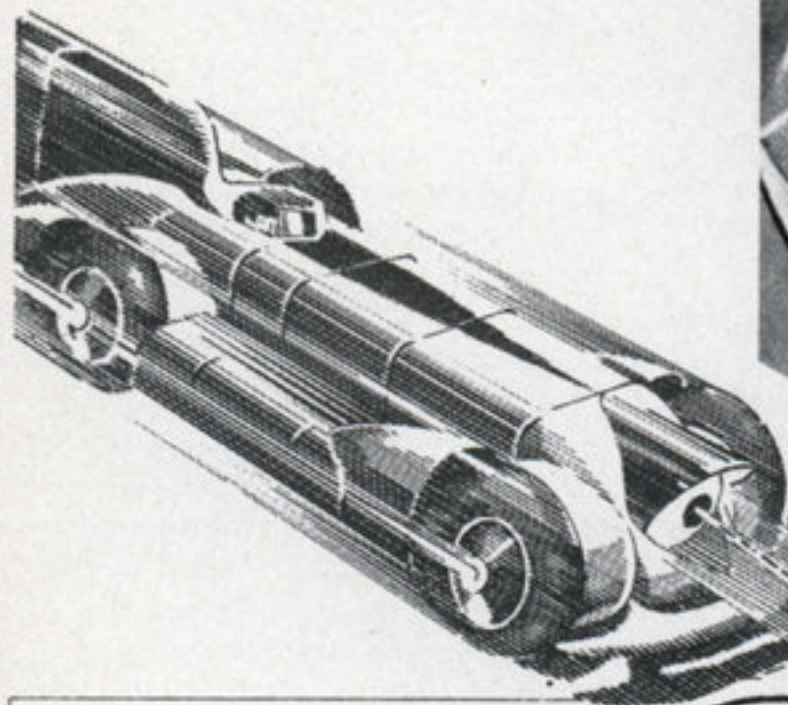


LIGHT BEAMS Steer SUPER RACING CARS

Speeds never before attained on land may become a reality if experiments with light beam, driverless cars are successful. Here are the mechanical features that will be involved.



The driver of the proposed super-speed racer can make movie record of car's performance. After starting, and putting it into motion he leaves driving responsibilities to the mechanical and electrical brain.



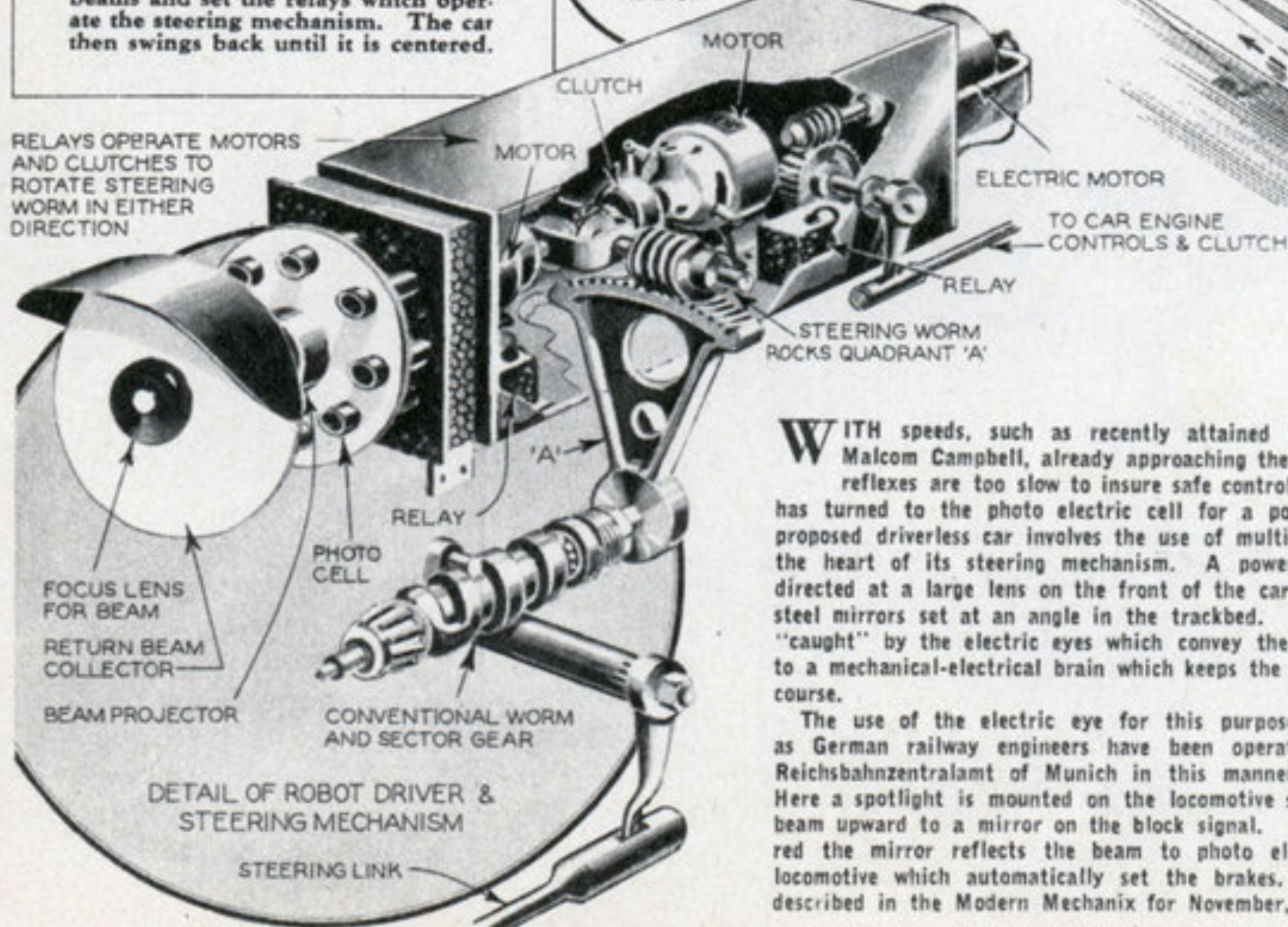
Above, the method of reflecting the light beam is clearly shown with the steel mirror inset in road is shown in the circle. The mechanical-electrical brain's operation is pictured below. If the car goes to the right, the electric eyes on the left side of the multiple eye pick up the beams and set the relays which operate the steering mechanism. The car then swings back until it is centered.



PROJECTED BEAM

REFLECTED BEAM

RELAYS OPERATE MOTORS AND CLUTCHES TO ROTATE STEERING WORM IN EITHER DIRECTION



WITH speeds, such as recently attained by the famous Sir Malcom Campbell, already approaching the point where human reflexes are too slow to insure safe control of the car, science has turned to the photo electric cell for a possible solution. A proposed driverless car involves the use of multiple electric eyes as the heart of its steering mechanism. A powerful beam of light directed at a large lens on the front of the car is concentrated on steel mirrors set at an angle in the trackbed. The reflections are "caught" by the electric eyes which convey the electrical impulses to a mechanical-electrical brain which keeps the speeding car on its course.

The use of the electric eye for this purpose is not surprising as German railway engineers have been operating trains on the Reichsbahnzentramt of Munich in this manner for several years. Here a spotlight is mounted on the locomotive so that it throws a beam upward to a mirror on the block signal. When the signal is red the mirror reflects the beam to photo electric cells on the locomotive which automatically set the brakes. This method was described in the Modern Mechanix for November, 1934.

Make Street Intersections PAY a PROFIT

RECORDS show that busy street intersections are the favorite spots in which traffic accidents occur. To eliminate these danger spots, J. G. Van Zandt, an engineer of Pittsburgh, Penn., has patented the idea of a safety-tower which practically eliminates the possibility of crossing collisions and at the same time returns a profit to the community.

Space above and below street level at intersections belongs to the city. Mr. Van Zandt's towers would be constructed at the intersection, as shown in the drawing below, and would contain stores, offices, and parking facilities which would return a handsome revenue to the builders.

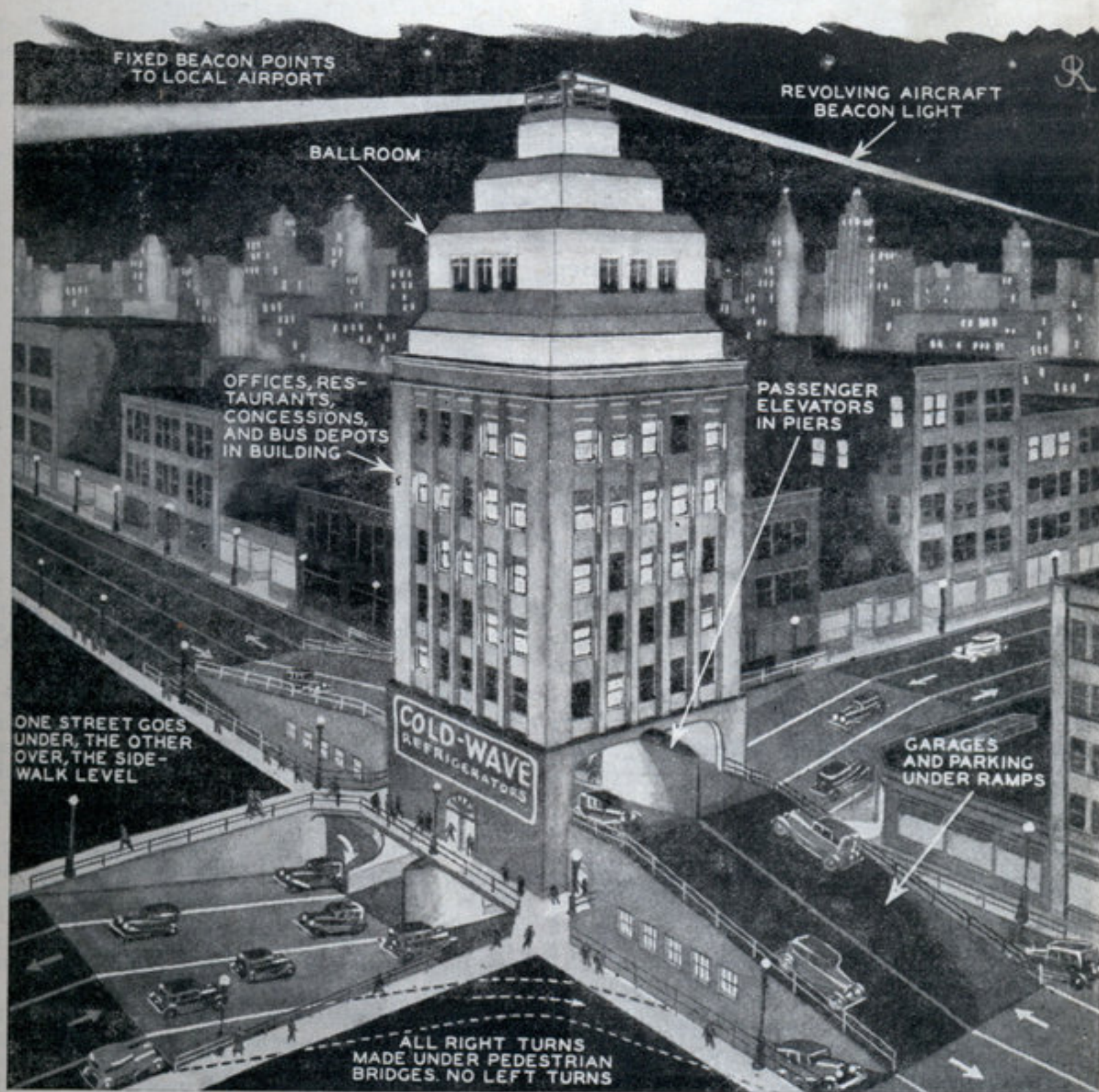
The safety feature is provided for by the two-level roadway. North-south traffic travels on one level, with east-west traffic pass-

ing above it, doing away with the need for stop and go signs, since traffic is continuous. Crossings for pedestrians are provided at street level; autos travel below and above the street, but not on its surface at the intersection.

Motorists making right turns pass underneath the pedestrian bridges. Left turns are not permitted. Parking facilities are provided for beneath the street level.

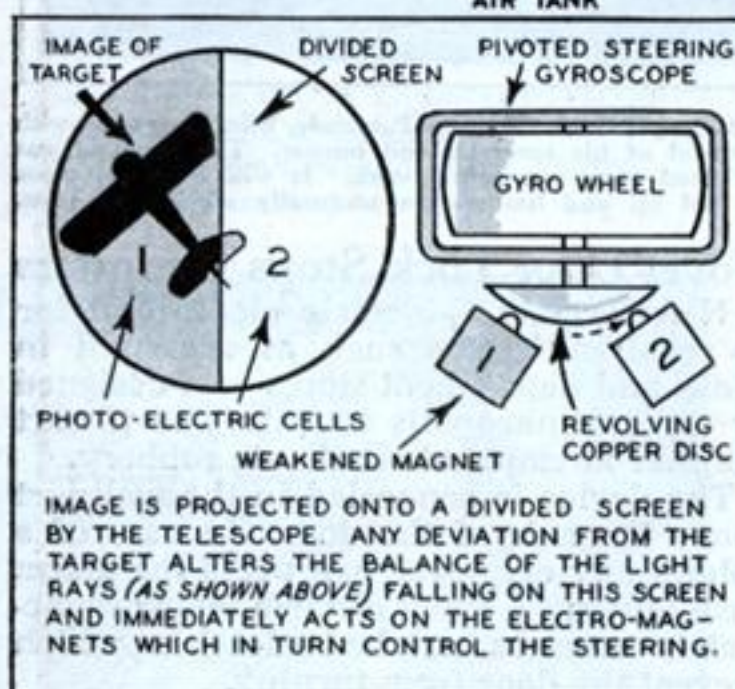
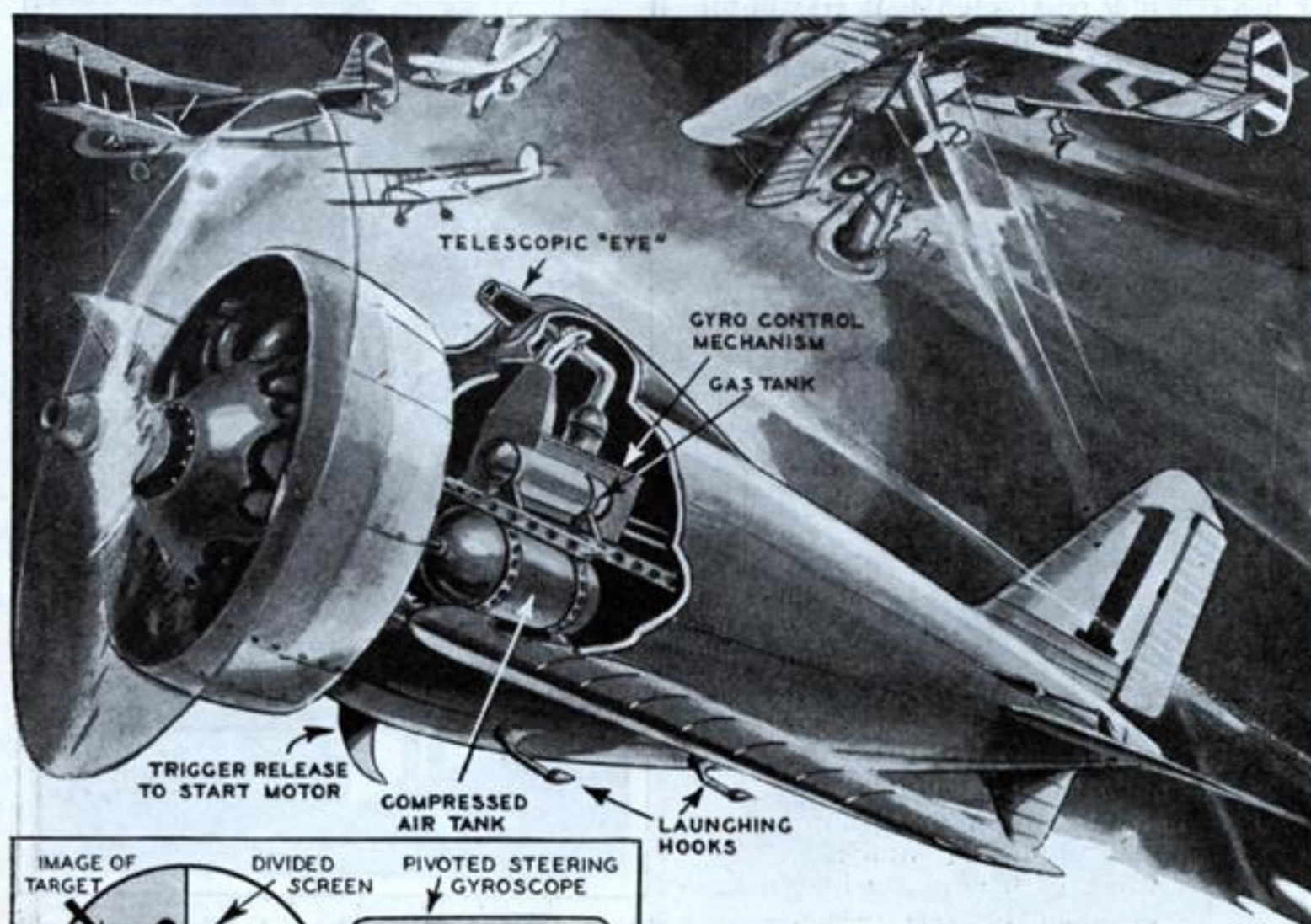
Revenue produced would depend largely on conditions at individual intersections. In many cases, Mr. Van Zandt believes, small cities can well afford to construct a safety-tower as a civic center building, satisfying local needs for city hall, banquet halls, public rest rooms, etc.

It is a simple matter to locate an air beacon on the top of the tower.



This safety-tower, to be constructed at street intersections, reserves street level for pedestrians and permits cross traffic to flow continuously, without regulation of stop and go signs. Rental of parking space, offices, and stores would return sufficient revenue to pay a profit on the tower's construction. This unique idea has been patented by J. G. Van Zandt.

ROBOT *Planes* to FIGHT



A telescope on the interceptor plane is focused on a divided field. The off course side weakens a current controlling the gyro steerer, bringing the ship on its course again.

WINGING their way with deadly precision towards the apparently unsuspecting city which is their objective the enemy bombers are alive with bustling activity as the bombing crews take station and prepare for the impending attack.

Although the machine gunners at their several posts keep vigilant watch for defensive interceptor fighters, no one is seriously alarmed at the possibilities of effective defense measures and even when the surrounding gloom is shattered with appalling

This is the way the robot planes, designed to use the Brown invention, will look when finally completed and ready for actual tests sometime during the coming year.

suddenness by the piercing glare of a hundred searchlights, there is little concern on the part of pilots and gunners of the swiftly approaching planes.

Are they not flying at an altitude of at least 20,000 feet and at a speed in excess of 200 miles per hour? What pursuit plane could hope to attain height and find them in the short time that will elapse before they, their awful mission accomplished, are miles away on the return journey and within protective range of their own fighters!

Suddenly the searchlights, which hitherto have contented themselves with an aimless probing of the starry vault, swing with deadly unison and pick them up. Almost instantaneously the cold hand of an unreasoning fear clutches at the squadron leader's heart as in the tremendous glare he sees the ship next in line disintegrate before his eyes. While he is still frantically groping for an explanation—for there have been no signs of gun fire—the wreckage goes whistling to its doom and is followed by another and yet another of the ships which comprise his command!

Some burst into flames or explode, but for

ENEMY AIR RAIDERS

by DOUGLAS ROLFE

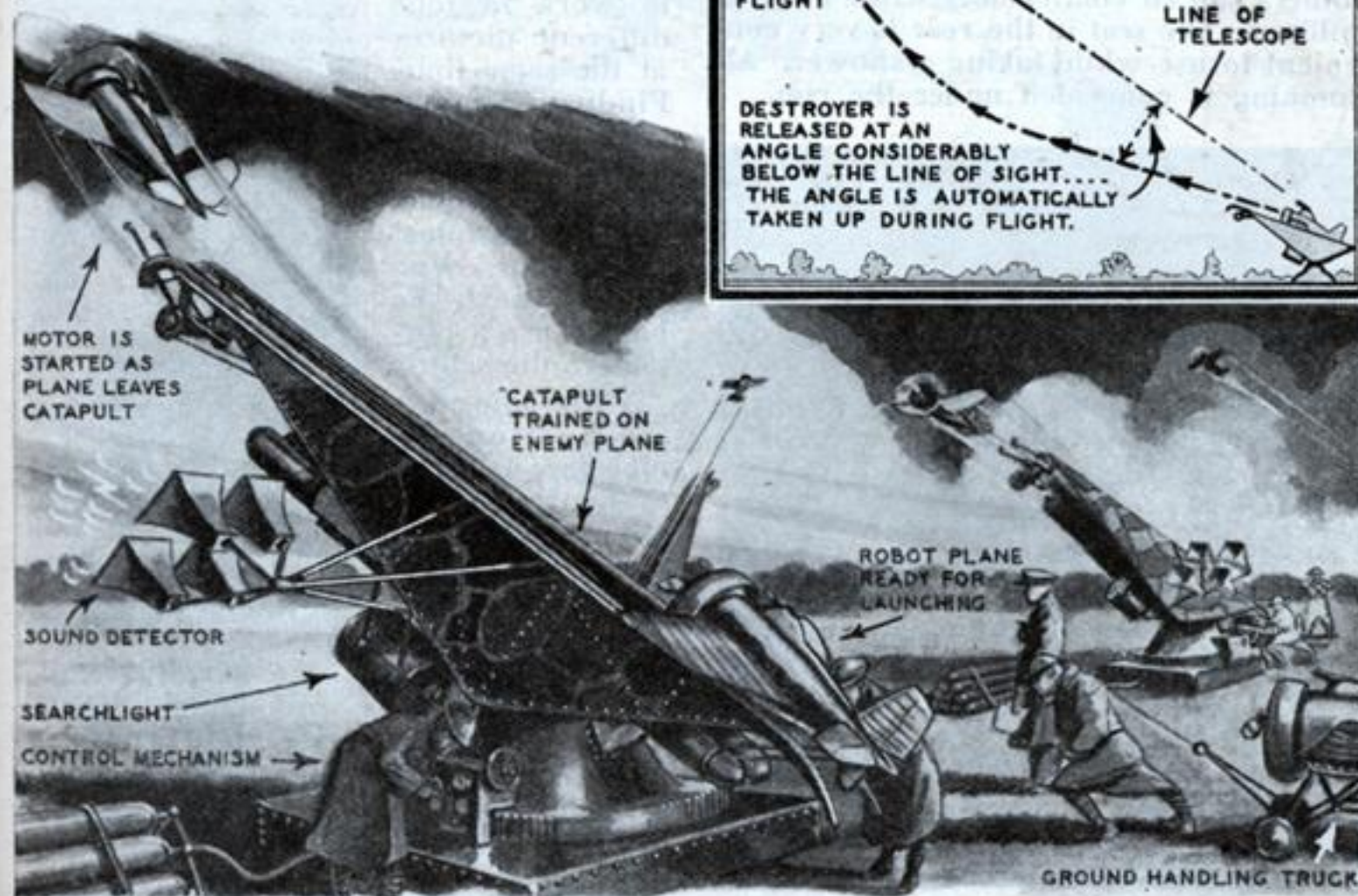
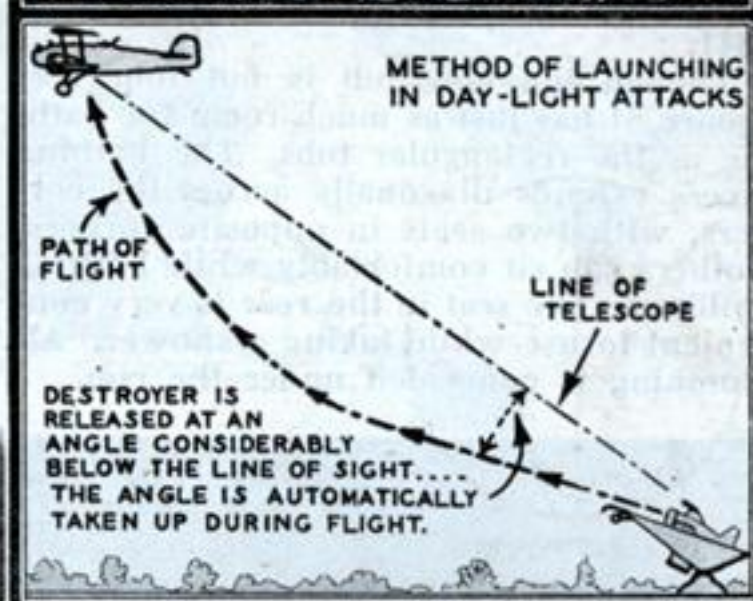
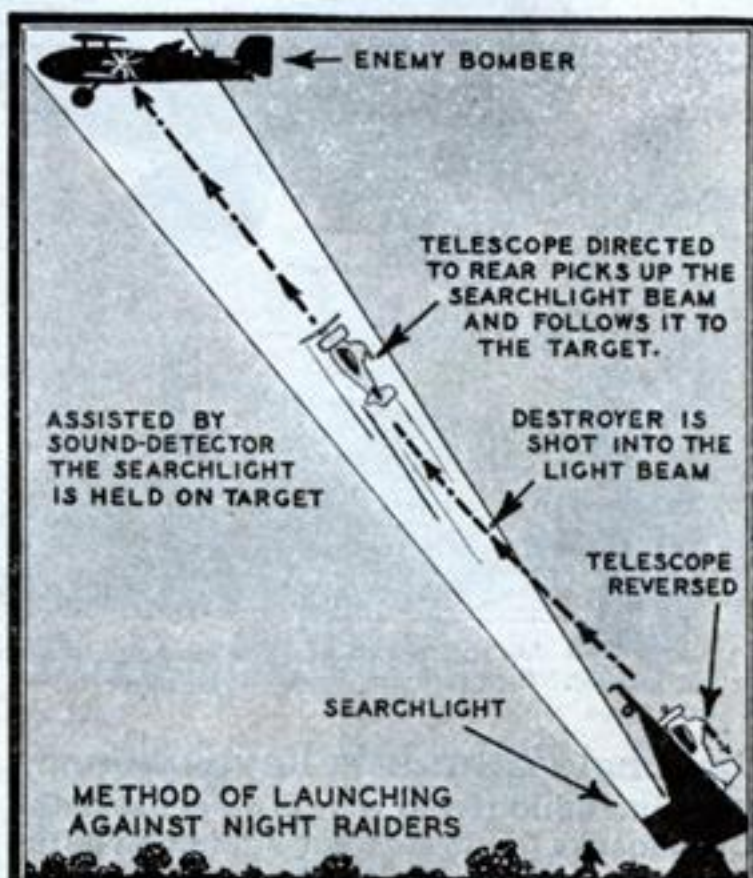
Automatic airplanes, steered and flown by special photo cell equipment invented by the Englishman, Mr. Sidney G. Brown, may revolutionize war air raids.

the greater part the stricken planes appear simply to crumple in the air. The illuminated night is full of falling planes and at this moment the bewildered commander's fear mounts to sheer terror when his ship staggers under a frightful impact from some unobserved object.

As the few lucky survivors hurriedly retreat from the scene of disaster there is muttered talk about collision in the air but all agree that, even allowing for the blinding glare of the searchlights impinging upon them, it is unthinkable that so many ships would have piled into each other. Yet here is practically an entire squadron destroyed within a few minutes of its objective!

This is the devastating picture painted for the outcome of bombing attacks in the future if Sidney G. Brown, world famous

(Continued on page 123)



The idea of the new English invention is to launch robot planes by catapults as shown. The robot planes will be highly powered, but lightly loaded as there will be no landing gears or crew. They follow a beam of light, and in reality are flown by searchlight beams. The present attack speed is tentatively set at 450 to 500 miles per hour.

The robots are coming!

*When they do, you'll
command a host of
push-button servants.*

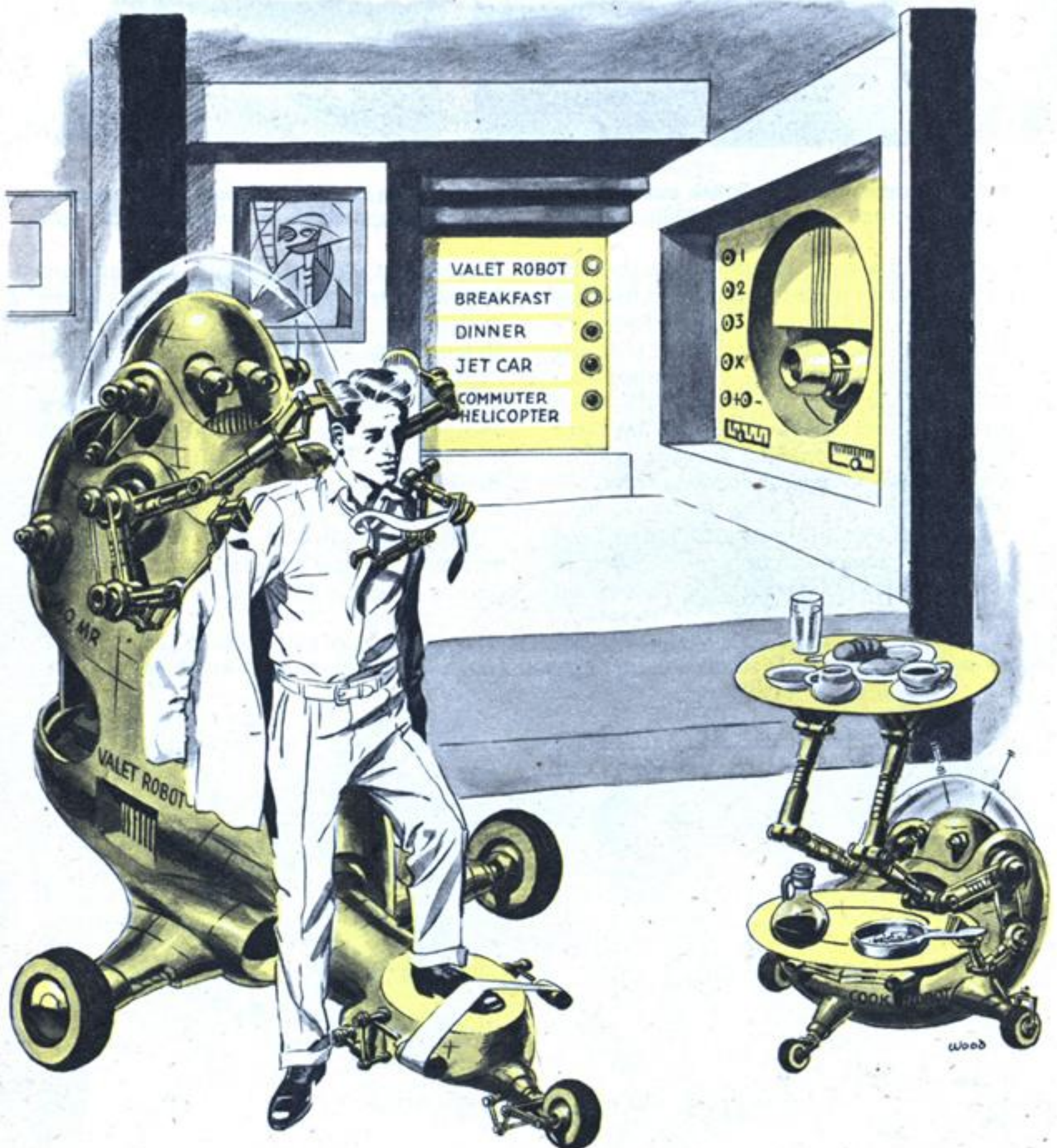
By O. O. Binder

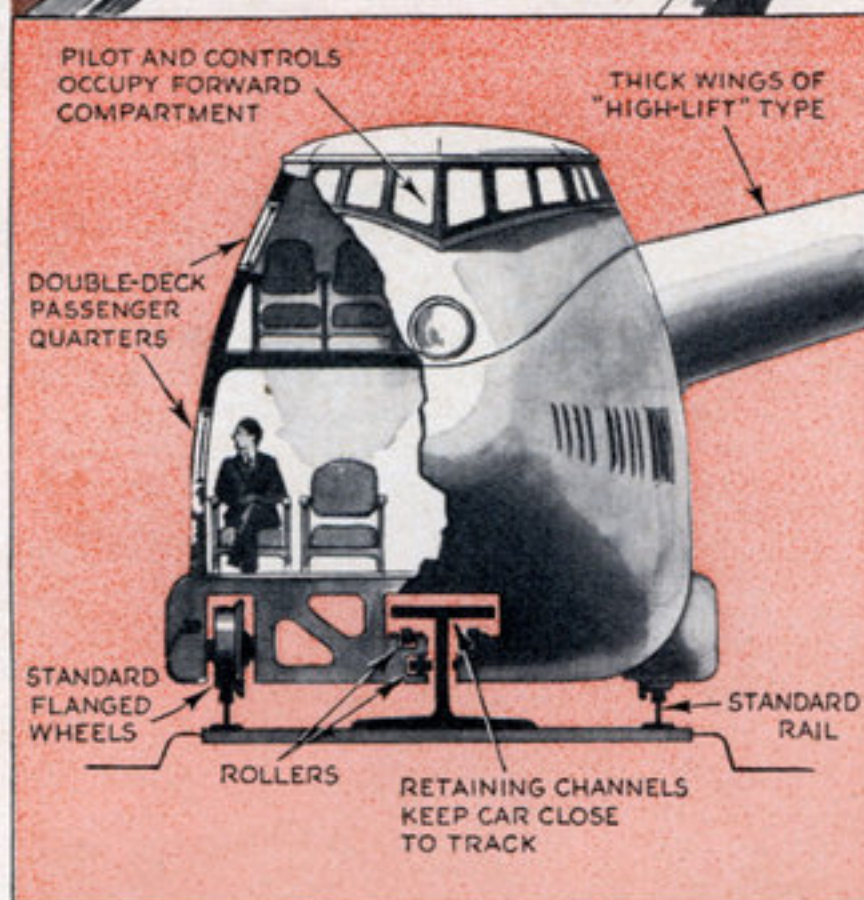
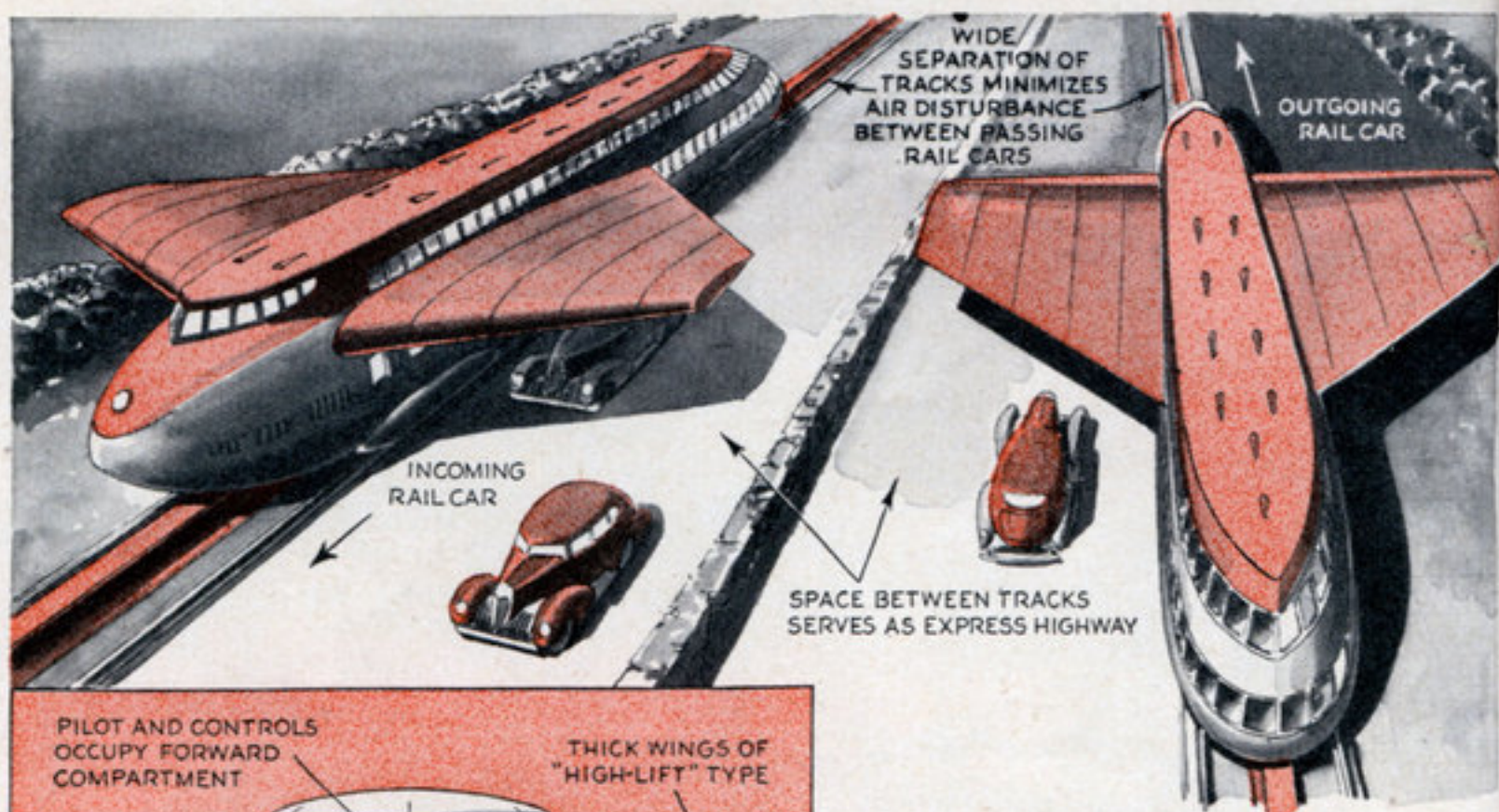
Robots will dress you, comb your hair and serve meals in a jiffy.

You'll Own

IN 1863, Abe Lincoln freed the slaves. But by 1965, slavery will be back! We'll all have personal slaves again, only this time we won't fight a Civil War over them. Slavery will be here to stay.

Don't be alarmed. We mean robot "slaves." Let's take a peek into the future

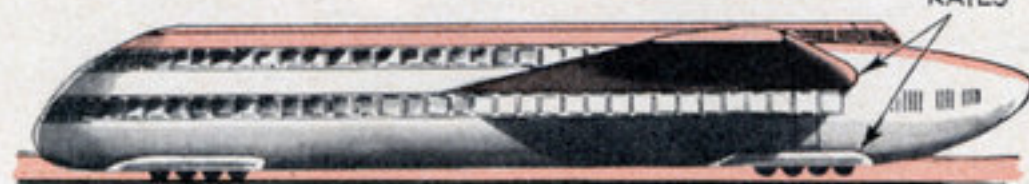




Broad motor highways fill the area between the tracks. The rail cars, as indicated at the left, are double-decked

Winged Rail Car Rides on Air

• •



At high speeds, the front wheels leave the rails, reducing friction

CAPTIVE airplanes with clipped wings would hurtle across country at more than six miles a minute, in a "flying-railway" system proposed by a European engineer. His scheme calls for a giant new type of streamline passenger car, having stubby wing surfaces and a body like the fuselage of an airplane. At low speeds, as in starting and stopping, the vehicle rolls along standard rails on flanged wheels at front and

the rails, continue to supply propulsive force from the vehicle's Diesel power plant. Passenger seats are arranged in pairs on the double decks of the curious train, while the engineer-pilot sits high in the front of the vehicle in a special cockpit resembling that of a modern transport plane. The space required between tracks, to allow clearance for cars traveling in opposite directions, would be used as an express automobile highway.